ASL Technologies, LLC

S-Series Cabinet

{S-30; S-40}

Operations and Maintenance Manual

S-Series Cabinets

ASL Technologies, LLC
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ASL Technologies, LLC
Quality Policy

ASL Technologies, LLC was founded with the commitment to be the industry leader in product quality, customer service and customer satisfaction in the market places we serve. Our patented product line of Electrostatic Fluid Filtration equipment is designed, built, tested and delivered with these goals in mind.

Congratulations on the purchase of your new **Finite Particle Removal System™ (FPRS).**

This manual covers models FPRS-S30-Cab and FPRS-S40-Cab

ASL Technologies FPRS S-Series Units provide state of the art fluid filtration that allows superior filtration capability at a minimum investment. Affordable electronics and compact design are combined to provide economic filtration without compromising the effectiveness of Electrostatics. Though compact in size, the S-Series can provide up to a year of replacement free filtration. It also provides effective cost recovery of valuable fluids and extension of component life in hydraulic, dielectric, and solvent systems.
ASL encourages you to read through this manual completely. Information has been provided in order that our customers can experience the maximum benefits resulting from extreme fluid cleanliness. Every situation cannot be anticipated and ASL is always available to help in any way possible. Critical information has been supplied to assist you with the theory, operation, and maintenance of the S-Series Finite Particle Removal System.™ Questions or concerns should be addressed to ASL.

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Quick Startup Guide

This section is intended for experienced users only! Please be sure to read the entire manual!

1. Unpack FPRS Unit from shipping box/skid.
2. Open Top Cover by grasping rolled lip and lifting up, like a car hood. Swing the top cover all the way back to the stop. The cover is hinged at the top rear sides, and held closed with magnets. Use caution when the top cover is open, shock or jarring may cause it to close suddenly and could cause personnel and/or equipment damage.
3. Remove front cover by pulling the top rolled edge toward you about 2 inches to disengage the magnets, and lift front cover clear of unit. The front cover fits outside the case sides and rests inside the case at the bottom.
4. Remove service manual package, oil sampling package and optional backflush hose package. (Don't lose the backflush hoses, you'll need them for unit servicing.
5. Check for any loose hoses, electrical connections, relays, etc. that may have occurred during shipping. (A laminated wiring diagram is pasted on the inside of the front cover)
6. **Remove the cardboard shipping spacer underneath the hydraulic pump/motor.**
7. Make sure the float switch is correctly positioned in the bracket/tray. The hinged float should be hanging down toward the bottom of the tray, such that a build up of fluid will raise the float and "close" the switch.
8. Verify that the THROTTLE VALVE on the inlet side of the W/A canister is OPEN.
9. Verify that the W/A drain valve on the bottom of the W/A canister is CLOSED.
10. Remove the plastic ½" NPT shipping plugs from the right side inlet and outlet bulkhead fittings. Plumb inlet and outlet hoses to your reservoir. Use Teflon tape or equivalent (Inlet to the lowest point on the reservoir, and outlet to the opposite side top of the reservoir) Make sure to drain any free water, which may have accumulated at the bottom of your reservoir.
11. Unwrap the power cord and connect to a grounded 10 amp 120 VAC outlet. **Note that the FPRS unit and your system reservoir must both have earth ground.**
12. Reinstall the front cover and close the top cover. (There is a safety switch on the top cover, that must be closed to allow incoming power to reach the power supply)
13. Turn the Power Switch to the "ON" position. The green "Power" lamp should illuminate. Note that the Red "Low Voltage" lamp illuminates momentarily, and then goes out.
14. The Fluid Delivery System (pump/motor) will immediately start and begin drawing fluid from your reservoir.
15. Note that the pump may need to be primed before any outlet flow is observed.
16. The S-Series pumps will only "lift" fluid about 18 inches (from the bottom of the cabinet)
17. Your system was tested with fluid, but the water absorber element/canister and the Electrostatic cell are dry when you receive your unit. It may take a few minutes for them to fill, before any fluid output is seen. If output flow and/or pressure rise on the gauge is not observed within 3-4 minutes, turn power "OFF" and make sure the inlet hose is primed.

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IMPORTANT SAFETY INFORMATION

READ CAREFULLY BEFORE ATTEMPTING TO ASSEMBLE, INSTALL, OPERATE OR MAINTAIN THE FINITE PARTICLE REMOVAL SYSTEM™. PROTECT YOURSELF AND OTHERS BY OBSERVING ALL SAFETY INFORMATION. FAILURE TO COMPLY WITH INSTRUCTIONS COULD RESULT IN PERSONAL INJURY AND/OR PROPERTY DAMAGE. RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE.

SAFETY ALERT SYMBOL AND SIGNAL WORDS

The following safety alert symbol and signal words are used throughout this manual to call attention to and identify different levels of hazard and special instructions.

This safety alert symbol is used with signal words **WARNING** and **CAUTION** to call attention to safety statements.

WARNING! statements identify procedures or practices, which must be followed to avoid serious personal injury or loss of life.

CAUTION! statements identify procedures or practices, which must be followed to avoid minor personal injury or damage to this equipment.

ELECTRICAL SAFETY

WARNING! ELECTRIC SHOCK can kill. Your FPRS uses a high **Direct Current** voltage of **15,000 volts**. Do not touch live electrical parts. Always disconnect power source before working on the system.

Avoid accidental starting. Make sure unit is turned “OFF” and is unplugged or disconnected from its power source before beginning any maintenance tasks.

This product and the fluid reservoir it services, must both be earth-grounded to operate safely and properly.

Protect the power cable from coming in contact with sharp objects. Replace or repair damaged or worn cords immediately.

Safety devices such as interlocks, fuses and circuit breakers should not be disconnected or shunted out.

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CAUTION! The power source must be fused for 10 amps.

1. The motor is designed for operation on the voltage and frequency specified on the motor nameplate.

2. Normal loads will be handled safely on voltages not more than 10% above or below the specified voltage.

3. Running unit on voltages not within range may cause overheating and motor burnout.

4. Heavy loads require the voltage at motor terminals be not less than the voltage specified.

Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

Install and maintain equipment according to USA Standard C1, National Electric Code.

Do not install FPRS unit's outdoors or unprotected from the elements. Do not use in a damp or wet location.

FLUID SAFETY

WARNING! Do not pump flammable or explosive fluids such as gasoline. Failure to follow this warning can result in personal injury and/or property damage and will void the product warranty.

CAUTION! Secure the discharge line before starting the system. An unsecured discharge line may whip, causing personal injury and/or property damage.

Explosive or flammable (flash point below 200° F) fluids must never be filtered with this product. **Electrostatic arcing is a potential ignition source.** Please refer to Fluid Specification prior to filtering fluid.

~ Do not exceed **45 psi** on any components in the system.

~ Protect fluid lines from damage or puncture.

~ Maximum fluid temperature should not exceed 165°F. **(175°F for Black Phosphate Ester Cells)** The Electrostatic Cell body can distort at higher temperatures, draining the reservoir and creating a floor hazard and severely damaging the hydraulic system.

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INTRODUCTION/SYSTEM OVERVIEW

The Finite Particle Removal System,™ Patent Numbers. 5,149,422, 5,242,587 and 5,891,315, (other Patents pending) uses the most advanced technology available to clean and reuse oil (i.e., transformer, hydraulic, turbine, lubricating) and solvents.

There are basically five (5) major factors contributing to the contamination of industrial fluids:

- Air
- Heat
- Water
- Particulate matter
- Oxidation of by products

Contamination of industrial fluids is a great concern because their condition is directly related to the condition of the overall system they function in. Controlling these five factors is foundational to maintaining a trouble-free system.

The following preventative measures do much to extend the life of the fluid and the hydraulic system. One must minimize the external ingression of air and particulate in the fluid. Breather bags and air intake filters have been used effectively for this purpose.

Maintaining the fluid temperatures within the specified limits can be achieved through proper care and maintenance of the cooling system. We have equipped your filtration system with continuous water removal capability to prevent build up due to condensation to keep the fluid dry.

Finally, the fluid must be kept as clean as possible, not only by removing particulate such as:

- Dirt
- Fibers
- Wear metals

Also, the **Submicronic Contaminants** such as:

- Silts
- Tars
- Varnishes

Tars and Varnishes are the byproducts of oxidation and typically occur and are encouraged because of the presence of air, heat and water. Oxidation is usually observed in lubricants and hydraulic oils and results in the formation and deposition of tars and varnishes on the components of the hydraulic system. Removing these contaminants continuously from the system will prevent the majority of problems that plague maintenance departments and cause expensive downtime. Keeping the fluid as clean as possible is what this product will accomplish for you and your company.

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The FPRS is designed to connect directly to your machine's reservoir. The FPRS draws the fluid into its system using a pump that sends the fluid through a water absorber and an Electrostatic Cell to accomplish the cleaning process. The fluid is then discharged through an output hose and back into your reservoir.

The FPRS utilizes a combination of electrostatic and magnetic fields to remove submicronic particles from the host reservoirs fluid. This is accomplished by electrically influencing the particles in the oil to opposite polarities. These + and - influenced particles are attracted to one another and are retained by polyolefin foam used within ASL's patented Electrostatic Cell. Because the foam is polyofin, water in concentrations of 500 ppm or less will not disrupt normal operations, although microamp readings of the fluid will be slightly higher due to the conductivity of water.

The cell operates with alternating electrostatic and magnetic fields. If, for example, a particle is negative, it will seek the positive side of a magnetic plate. When the particles begin to collect together, one on top of the other, alternating as positive and negative particles, the polyofin foam filter inside the cell becomes a home for the particles and holds them in place. This collection of particles is a phenomenon known as *"strawing."*

Your FPRS comes equipped with a water absorption unit that can remove free and emulsified water down to 50 PPM. This feature covers a wide range of water problems.

Each fluid to be cleaned has its own characteristics, which may require modifications in magnetic field density and the dedicated collection media used within the electrostatic cell. The cell provided in your unit has been built to meet your specific requirements. Therefore, when discussing your unit with us or when ordering cells, be sure to state the correct model number of the cell. The model number is shown on a red tag on top of the cell, i.e. R61CS-115, R62CS-115, etc. Note that Phosphate ester fluid compatible cells have a "B" in the parts number, i.e. RB64CS-115, etc. Mineral oil cells have a Gray tube, and Phosphate Ester Cells have a Black tube.

The long-term benefits of continuous filtration with this product, as the contaminants are purged from your system, will become evident through reduced downtime and maintenance expenditures, extended machine life and greatly improved fluid life. Coupled with our water absorber this product will protect the lifeblood of your hydraulic system from three of the five major factors that contribute to fluid degradation.

- Water
- Particulate Matter
- Oxidation by products

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IMPORTANT GUIDELINES

Oil temperature should not exceed 165°F for electrostatic cells.
(175°F for black tube Phosphate Ester Cells)

Ambient air temperature should not exceed 160°F.

Viscosity of the oil to be cleaned cannot exceed 1800 SUS @ 100°F.

The minimum flash point of the oil should not be below 200°F

FPRS S-Series units will automatically restart if input power is momentarily lost.

Concentrations of ***water should not exceed 500 ppm.*** If in excess, a water absorber should be used to reduce the content to an acceptable level (less than 500 ppm) before the electrostatic cell is employed.

It is recommended the FPRS input hose be connected to or draw from the lowest point of the reservoir. Therefore, when hooking up to a reservoir for the first time or after a period of non-filtration, always drain free water from the bottom of the reservoir before using the FPRS.

The output hose should be returned to the highest point at the opposite end of the reservoir to ensure maximum distance between the input and output hoses.

When installing an FPRS S-Series unit on an elevated reservoir where the lowest fluid level of the reservoir is higher than the FPRS, it is recommended that shut off valves be installed in the line running from the reservoir to the FPRS pump (inlet). As well as the line running from the FPRS back to the reservoir (outlet).

When installing an FPRS S-Series unit above the highest level of fluid of the reservoirs it is required that the pump be primed. Once primed, the cabinet of the S-Series can be elevated as high as 24" above the highest level of the reservoir.

SYSTEM SAFETY FEATURES, INDICATORS, SWITCHES AND LIGHTS

Your FPRS S-Series unit comes equipped with several enhanced safety features and light/gauge indications that are designed to provide operator and environmental safety, ease of operation and troubleshooting. The following paragraphs contain a brief description of these features. Refer to the photos on pages 11, 12 and 13, and the wiring diagram on page 28. Note that the wiring diagram is also laminated and glued to the inside of the system front cover. The Maintenance section, beginning on page 30, provides further details on operation and troubleshooting.

1. POWER SWITCH

This switch controls power application to the system, and is in the power line after the 10 amp circuit breaker which is located next to the power switch. When the system is plugged in to a 120 VAC power source, power will be present on one side of this switch. Note that if incoming 120 VAC power is interrupted while the "POWER" switch in the "ON" position, the system will automatically restart as soon as incoming AC power is restored.

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2. SYSTEM CIRCUIT BREAKER

Located between the ON/OFF switch and the Green Power lamp, the system circuit breaker is rated at 10 Amps.

3. GREEN "POWER" LIGHT

With the cover closed, and the power switch is 'on', power flows to the green "POWER" lamp, which illuminates to indicate power is applied to the system. The green POWER lamp is a neon tube lamp that is designed to glow for many hundreds of hours. These lights are "non-relampable" and must be replaced completely when defective. See the "MAINTENANCE" section for instructions.

4. RED "LOW VOLTAGE" LIGHT

When the system is first turned on, or power is restored following a power interrupt condition, the red "LOW VOLTAGE" lamp will illuminate briefly, and then go off. The "LOW VOLTAGE" lamp does not indicate trouble with the incoming 120 VAC power, but relates to the high voltage DC power supply, which supplies 15,000 VDC to the Electrostatic Cell. The signal to illuminate this light comes from a relay internal to the high voltage power supply (yellow wire) which opens at approximately 700 micro amps. If this lamp illuminates, it indicates that the high voltage DC power supply output voltage is low, and could be caused by a variety of reasons. When the "LOW VOLTAGE" lamp is illuminated, power to the pump/motor is interrupted. Refer to the "Maintenance" section.

5. AMBER "BACKFLUSH" LIGHT

This lamp comes on when the Electrostatic Cell needs to be back-flushed with shop air. The signal to illuminate this light comes from a relay internal to the high voltage power supply (orange wire) which closes at approximately 500 micro amps. If this lamp illuminates, back-flush the Electrostatic Cell in accordance with the instructions on page 20 of this manual.

6. RED "FLOAT SWITCH" LIGHT

Illumination of this lamp indicates that there is either a fluid leak inside the FPRS, or the float switch has been upset during shipping, or recent movement of the unit. Note that this is a "latching" fault, and will not reset itself, even if the float switch re-opens. Power must be turned "OFF" and then back "ON" after correcting the fault. The float switch which activates this fault is located in the drip tray in the right rear corner on the bottom of the FPRS cabinet. Note also that even though the pump stops, the 15,000 VDC is still applied to the terminals of the Electrostatic Cell while power is on.

7. RED "OVER PRESSURE" LIGHT

Illumination of this lamp indicates an overpressure condition has occurred. Note that this is a "latching" fault and will not reset itself, even if the overpressure condition clears. Power must be turned "OFF" and then back "ON" after correcting the fault. The overpressure light is actuated by a pressure switch between the pump outlet and the water absorber canister. As in #6 above, 15,000VDC is still applied to the Electrostatic Cell while this fault is latched.

8. "MICROAMP" METER

The Microamp meter indicates the amount of high voltage DC power being consumed by the Electrostatic Cell. Under normal conditions, the Microamp meter will indicate between zero and 400, and is a way to determine the general condition of the Cell. Note that high concentrations of water, or excessive accumulations of ferrous particulate can cause high microamp readings. At 500 microamps, the amber "BACK-FLUSH" lamp will illuminate, and at 700 microamps, the red "LOW VOLTAGE" lamp will illuminate, the system will shut down, with the lamp remaining illuminated.

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9. "ELAPSED TIME" INDICATOR

The elapsed time indicator shows, in hours and hundredths of hours, how long the system has been running. Note that power is supplied to the hour meter from the pump/motor start signal, and will only run when the pump is receiving power. The hour meter reads to 99,999.99 hours (11 years)

10. SYSTEM PRESSURE GAUGE

The system pressure gauge, viewable through the hole in the front cover, shows system pressure downstream of the pump. Under normal operating conditions (warm fluid, fresh water absorber element, fresh Electrostatic Cell, no output hose restrictions, etc.) the gauge will read approximately 10 to 25 psi. A higher initial reading may be caused by cold or thick fluid. Over time, it is normal for the gauge to indicate progressively higher pressure, due to accumulation of water in the water absorber element and/or excessive particulate accumulation in the Electrostatic Cell. At 35 psi. it's time to find the cause of the excessive pressure, which can only be caused by a clogged water absorber element or Electrostatic Cell, or some restriction in the lines downstream of the pump.

11. REMOTE ALARM CONNECTOR

The Remote Alarm connector, located on the right side of the cabinet near the power cord entrance, is a two wire .250 male spade connector that can be interfaced to a remote alarm or PLC. The signal runs through two dry sets of contacts in relays CR-1 and CR-3. When the system is operating normally, these contacts are "closed." In the event of any internal failure, these contacts "open." If these connections are used, do not exceed 24 VDC.

12. OIL SAMPLE PORT

The oil sample port is located in the pump outlet line, just below the system pressure gauge. This test port makes a convenient, leak and contamination free port to draw oil samples. On earlier models, a Parker sample valve was used. To use this style port, unscrew the cap from the port (the chain prevents cap loss) and use a suitable sampling "push to test" valve from Parker, Stauff, or others, to draw the sample. On later models a KP series thumb push sample valve is employed, requiring no special tools of fittings to use. In either case, push the sample valve in for 30 to 60 seconds and flush the sample port into a waste bucket. Using a clean sample bottle, remove the lid and invert it to prevent ambient dust or dirt from contaminating the sample. Fill the bottle to within ½" of the top. Immediately install the cap securely. Note that this port is before any FPRS filtration. Note also, that the FPRS must be running to draw the sample. On models equipped with the KP "push to test" sample valve, a sample hose and bottle are attached at the factory.

13. WATER ABSORBER DRAIN BALL VALVE

This (Normally Closed) drain valve, located at the bottom of the water absorber canister, is used to drain the canister when replacing the water absorber element. An 18" long gray drain hose is attached to the drain valve, and the hose end is folded and ty-wrapped when you receive your FPRS. The hose is stowed behind the absorber canister.

14. WATER ABSORBER INLET SHUT OFF BALL (THROTTLE) VALVE

This (Normally Open) valve, located just above the pressure gauge, is used during water absorber replacement, and when setting the pump by pass and pressure switch pressure. Note that this valve is located on the pressure side of the pump, and should always be open, unless pump/pressure switch adjustments are being made.

15. COVER SAFETY SWITCH

Once the power switch is placed in the "ON" position, power flows to one side of the cover safety switch. With the cover in the open position, power is interrupted, preventing operation of the FPRS.

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S-Series Front Panel Controls and Indicators

(See pages 8 – 10 for detailed function)

System Pressure Gauge (10)

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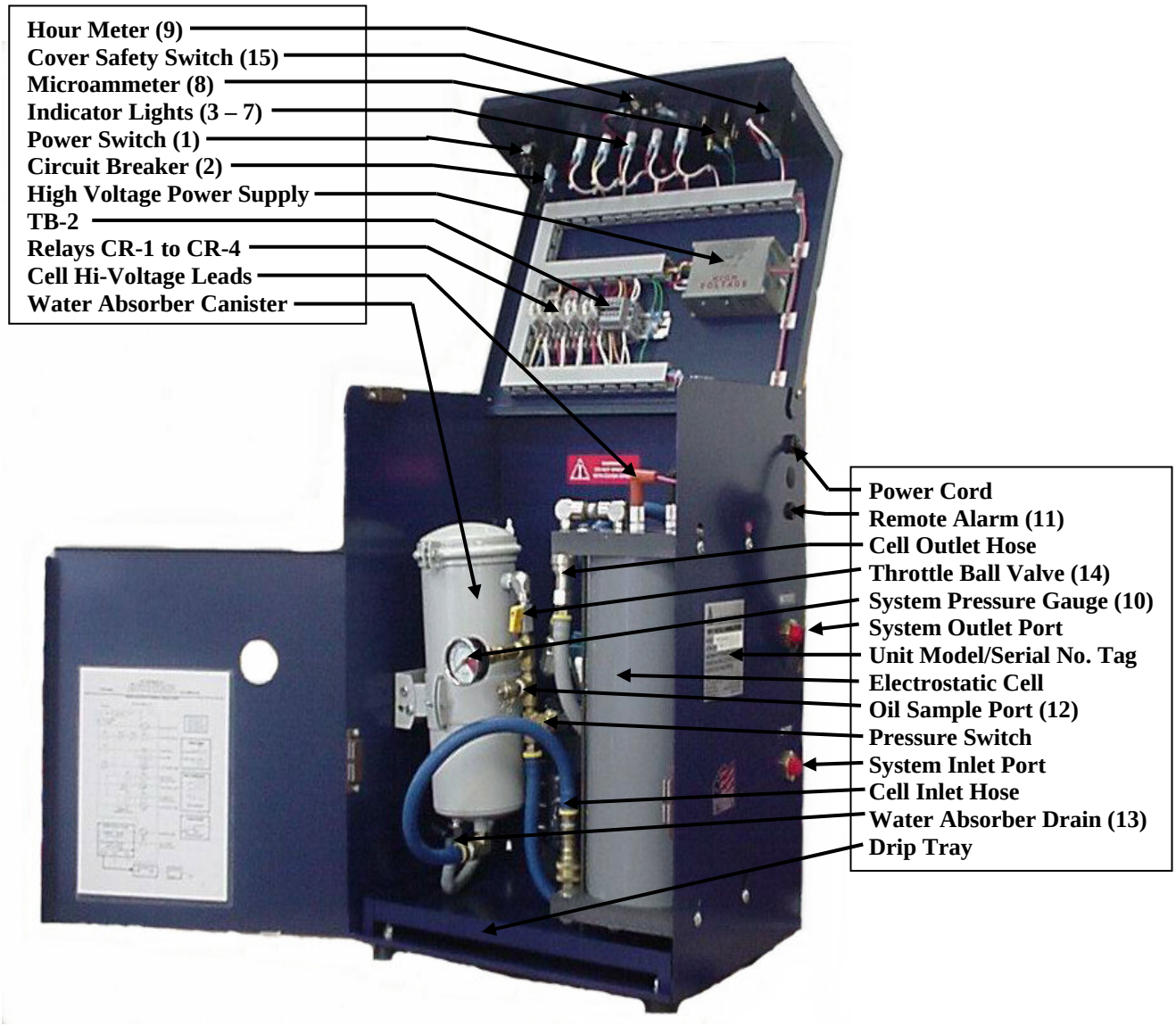
S-Series Internal Component Locations

Refer to descriptions on pages 8 – 10. Numbers in ( ) refer to descriptions.



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Drip Tray and Float Switch

Electrostatic Cell removed for clarity.

Disconnect 2 pin Molex, and carefully remove tray for draining.

Float Switch stays in Tray

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SYSTEM PREPARATION

NOTE: IT IS EXTREMELY IMPORTANT THAT THE FOLLOWING STEPS BE DONE IN ORDER TO ENSURE PROPER SET-UP AND OPTIMUM RESULTS FROM THE FPRS!

CAUTION! Before making power connections to this ASL unit, check the polarity of your power source***. Also verify that earth ground is present.***

Open the hinged top cover, (two magnets hold the cover closed) and swing it back. Remove the front cover by pulling it toward you (also held in place with magnets) and lifting it out of the way, to expose the internal mechanisms.

Check the wire and hose connections to and from the FPRS. It is important that these connections are tight and have not shaken loose during shipment. Tighten the connections if they are loose. ***Do not over-tighten.***

Check the quick disconnects on the cell to ensure that they are locked in place. (The outer ring of the quick disconnects slide back to lock and unlock the disconnect.)

The S-Series CABINET models will not operate with the front cover removed.

Take a sample of the fluid to be cleaned.

- Use a clean bottle to take the sample.
- The sample should be taken from the lowest point of the reservoir, preferably the drain cock or valve, because this is where the FPRS input hose will draw from. Free water should be drained from the reservoir before the FPRS is hooked up.
- Test the sample to ensure that the fluid does not surpass the guidelines of the system as set forth in this manual.
- For in-service oil analysis, a sample port has been provided, and is located at the inlet to the water absorber canister, just below the pressure gauge. (See page 10 for sample port operations.)

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INSTALLATION CONSIDERATIONS

APPLICATION COMPATIBILITY

While this product can provide effective filtration over a wide range of applications, there are some applications that are an exception.

- Type of fluid to be filtered.
- Contamination source or sources.
- The rate of contamination.

The following guidelines should be considered before installing this product.

1. Fluid Specification—this product is suitable for filtering nonconductive and semi-conductive fluids with viscosity rating less than 1800 SUS @ 100° F. ***Water based fluids cannot be filtered with this product.***

   Typically compatible fluids include:

   - Petroleum-based lubricants
   - Solvents
   - Synthetic lubricants
   - Dielectric fluids
   - Phosphate Ester, fireproof fluids (Requires different Electrostatic Cell, hoses, seals, gaskets, etc.) Phosphate Ester Cells are BLACK with White ends.

Check with ASL prior to filtering fire-resistant lubricants as these are extremely destructive to certain plastics and seal materials. ASL sells (or can modify existing) units for Phosphate Ester fluid filtration. S-Series units built for Phosphate ester operation will have “P” in the Model number i.e. **FPRS-S40P-Cab**

2. Contamination Type—non-discrete type contamination cannot be filtered with electrostatics. This includes contamination from other fluids or chemical property altering contaminants. Systems with chronic water ingression cannot be filtered effectively unless the source of water can be eliminated or greatly reduced to less than 600 ppm.

3. Contamination Rate—systems that produce excessive contamination may quickly overwhelm this product, especially if the contaminant is conductive (i.e. EDM, grinding and polishing systems, etc..)

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The FPRS is now ready to be charged (filled) for operation and tested to ensure that no connections have loosened during shipment. The FPRS should be charged with the same fluid it has been designated to clean.

INSTALLATION

APPROPRIATE LOCATION

Avoid locations that expose this product to excessive moisture and explosive environments. This product generates an electrostatic field that may disturb or damage sensitive electronic equipment. Also, remember that access to this product is required periodically to replace the electrostatic cell. Finally, avoid installing in high traffic areas where this product may be easily damaged by vehicles, forklifts, etc.

SYSTEM CONSIDERATIONS

1. Main Power Supply Source

- 120 volts AC, 60 Hz, single phase. (or 120 volts AC, 50 Hz, single phase, if equipped with 88471 Motor)
- 10 amps Circuit Breaker.
- 16 ga. Power cord provided.
- Earth Ground.
- Vertical Orientation.
- Ambient temperature less than 160°F.

2. Fluid Delivery

Pump/Motor –The self-contained pump and motor delivery system allows for continuous filtration, even during machine downtime. Installation is convenient and maintenance does not require shutting down the hydraulic system. A pump /motor assembly is provided which is designed to be compact, and is for continuous-duty, maintenance free and has been sized for the correct flow rate.

3. Hydraulic Connections

All the connections between the reservoir and the cabinet can be with hard-piping or hose connections. On the S-Series units, ½ ” NPT bulkhead fittings are provided for your convenience on the right (power cord) side.

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4. **Mounting Surface**

The S-Series Cabinet Model has cooling vents on both the back and bottom, allowing wall mounting, or floor placement. For wall mounting, keyhole slots are provided on the back panel of the unit. An optional floor dolly can be purchased or fabricated locally, to provide mobility of the cabinet to so it can be moved for servicing machinery that it is in close proximity. However you decide to mount the cabinet, allow 6 inches of space between the back or bottom louvers for pump/motor cooling. See the outline drawings on pages 42 & 43 for dimensions.

5. **Remote Alarm**

If a signal is desired to provide remote indication of an alarm condition, the S-Series Cabinet Models provide dual quick—connect interface with two internal dry relay contacts to interface with a signal not exceeding 24 volts. The relays are closed during normal system operation. During an alarm condition, such as overload, the relay will open. A second access hole is provided if hardwiring is required by your electrical codes. These connections are located on the right side of the cabinet, just below the power cord.

6. Water Absorption

Equipping the filtration system with water absorption capabilities maintains constant fluid dryness and prevents moisture build-up from condensation in the reservoir. The S-Series units are equipped with a water absorber unit that is installed between the fluid delivery system (pump) and the cell. This filter will also trap contaminants 5 microns and larger, and should be replaced whenever water content increases, or pressure rises above 30 - 35 psi. Replacement elements are available from ASL.

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HOSE CONNECTIONS

It is recommended that connections to reservoirs be made with quick disconnects or hard plumbed to minimize ingression of contaminants when hooking up and operating the FPRS.

- Connect the input and output hoses to the FPRS.
- Connect the input hose to the fluid reservoir. If there is no place to secure the hose, simply place the hose in the fluid near the bottom of the tank.
- Place the output hose into the fluid reservoir at the top of the tank
- When installing an FPRS S-Series on an elevated reservoir where the lowest fluid level of the reservoir is higher than the FPRS, it is recommended that shut-off valves be installed in the line running from the reservoir to the FPRS pump (inlet). Also, the line running from the FPRS back to the reservoir (outlet).

CAUTION! HANDLE THE HOSES SO THAT SPILLS CANNOT TAKE PLACE.

SYSTEM START-UP

- Connect the FPRS to a grounded **120VAC**-power source.
- **Both the FPRS and the hydraulic system reservoir must have earth ground**.
- Ensure that the shut-off valves on the input and output lines are open.
- Locate the drain valve on the bottom of the water absorber canister and verify it is in the closed position.
- Locate the Throttle valve on the inlet side of the water absorber canister, and verify that it is in the open position.
- Place the front cover in position and close the top cover.
- Turn the "POWER" switch on the front panel to the "ON" position. The green "POWER" lamp will illuminate and remain on. Note that the red "LOW VOLTAGE" lamp will flash and then remain off.
- The FPRS pump will start running, and draw fluid from the reservoir into the FPRS.
- Check for any external leaks.
- Turn the "POWER" switch "OFF."
- Open the top cover and remove the front cover.
- Check to ensure there are no leaks internally.
- Locate the red tag on top of the Electrostatic Cell. Fill in the "**Date Installed**" in the space provided. This will assist you in determining when an annual cell exchange will be required.
- Replace the front cover and close the top cover.

You are now ready to begin normal operations.

Your FPRS system has been designed to operate continuously on a fluid reservoir with little operator attention. However, it is recommended to check the control panel daily to monitor system condition. (See page 40 for Scheduled maintenance Tasks.)

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FLUID MAINTENANCE

The following recommendations are made in the interest of maximizing the benefits available with the S-Series FPRS system.

1. Periodically monitor the condition of the machine fluid. The following is a list of recommended tests that should be performed:
   - ♦ Viscosity
     When compared to values for virgin oil, the viscosity gives an indication of excessive thinning or thickening resulting from oil breakdown.
   - ♦ TAN
     When compared to values from virgin oil, an increase on the TAN indicates oil serviceability with regard to oxidation or contamination with an acidic product.
   - ♦ Particle Count
     Monitors the oil cleanliness level to provide indication of filter efficiency and potential wear failures.
   - ♦ Water
     Indicates the presence of moisture of coolant in the oil. For detection of water content below 1000ppm, the Karl-Fischer method can be used.
   - ♦ Spectrochemical Elemental Analysis
     The presence of elements in solution, i.e. additives, wear metals and contamination elements.

     FT-IR—Estimation of oxidation levels.

     PIXIE—Analysis of contaminant residue on patches.

3. When the condition of the oil is in question, it is usually more economic with small reservoirs to simply replace the oil than it is to spend money on extensive testing. Tests should be used to analyze potential problems in the machinery, not necessarily to determine oil life in these cases.

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CELL BACKFLUSH OPERATION

Backflushing of the cell is unique to ASL's Finite Particle Removal System™. This operation allows the cell to be reused without being replaced under normal use. (***Under normal operation, Electrostatic Cell and water absorber should be changed annually***)

When the cell becomes filled with contaminants, (about 500 microamps) and/or the amber "BACK-FLUSH" lamp illuminates, the cell needs to be backflushed.

WARNING! Turn OFF the FPRS on the control panel and at the electrical source.
Disconnect the input and the output hoses from the cell and set aside.
Connect a backflush hose to the quick disconnect at the bottom of the cell.
Place the end of the bottom backflush hose into a suitable container.
Using a second backflush quick disconnect fitting, connect plant air supply ***(REDUCE TO 10 PSI)*** to the quick disconnect at the top of the cell.

Allow 10 psi of air to flush the contaminants out of the cell and into the pail for disposal.
Leave the air pressure on until contaminants are no longer dispensed out of the backflush hose. (about 10 minutes)

CAUTION: BACKFLUSH HOSE WILL JUMP AROUND AS AIR REACHES IT!

Remove the backflush hoses and replace the input and output hoses to the top and bottom of the cell at their original configuration, blue hose to the bottom of the cell disconnect and gray hose to top of cell. (The top of the cell connects directly to the bulkhead output fitting)
Turn **ON** the electrical service to the FPRS™
Restart the system and check the amber "BACK-FLUSH" light to ensure that it has gone out. If it remains on, refer to the **"Maintenance"** section of this manual.

Observe that the microamp meter is now below 500 microamps.

Over time, backflushing may no longer be effective, and the Electrostatic Cell must be replaced.

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CELL REMOVAL/INSTALLATION

Under normal operating conditions, cells should be changed **annually**. When you replace your electrostatic cell, perform the following steps:

1. **WARNING!** Turn **OFF** the FPRS on the control panel and at the electrical source.
2. Open the top hinged cover, and remove the front cover.
3. Disconnect the high voltage wires as follows:
4. **WARNING!** Short across the positive and negative electrodes using a screwdriver with an insulated handle to dissipate static electricity.
5. **WARNING!** Each cell has a **positive (red)** lead and a **negative (green)** lead connected to it. **NEVER** touch both leads at the same time.
6. Disconnect the high voltage wire connections leading to the top of the cell; ***using one hand,*** grasp the boot connected to the green wire and pull up. Repeat with the boot connected to the red wire.
7. Remove the input and output hoses by releasing the quick disconnects.
8. Loosen 4 attaching screws from outside of the cabinet and lift the cell out of the cabinet.
9. Replace with a new or rebuilt cell. Ensure that the cell is inserted correctly with high voltage electrodes pointing upwards.
10. Attach quick disconnects with blue hose to the bottom of the cell and gray hose to the top of the cell. Note that Phosphate Ester Units use all Black Hose. The hose connected to the TOP of the Electrostatic Cell leads directly to the cabinet "Outlet" port.
11. Replace the high voltage wires to the cell. **Red is positive, Green is negative.** The label at the top of the cell notes the positive and negative electrodes. Be sure to fill in the "**Date Installed**" on the cell tag.
12. Replace the front cover and close the hinged top cover.
13. Restart the FPRS and operate system for a few minutes. Ensure that fluid is being dispensed through the output hose.
14. **WARNING!** Once fluid is dispensed through the output hose, turn **OFF** the FPRS on the control panel and at the electrical source.
15. Open the top cover and remove the front cover and check for leaks.
    Replace the front cover and close the top cover. The FPRS is now ready to resume operation.

S-Series Cabinets

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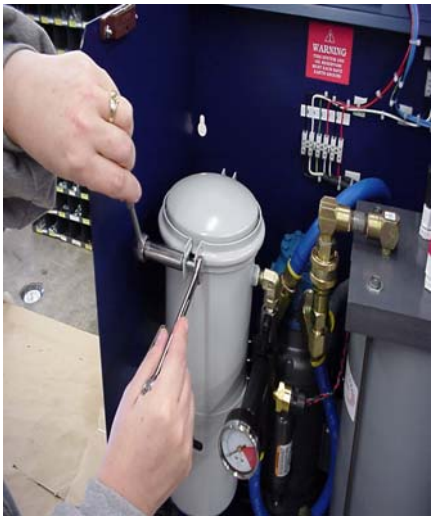
WATER ABSORBER ELEMENT REPLACEMENT

If the pressure gauge on the water absorber element is above its normal running pressure, it may need to be replaced. (>35 psi)
WARNING! Turn **OFF** the FPRS on the control panel and at the power source.

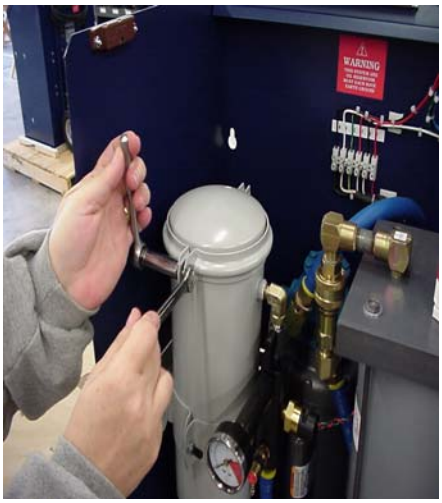
Open the top cover, and remove the front cover.



Locate the absorber drain hose. (It is folded over and tie-wrapped) Cut the tie-wrap and place the hose in a pail. Open the drain valve on the bottom of the absorber canister.

Loosen and remove the Clamp at the top of the canister and remove the lid.

Remove the element hold down bolt, and lift out the old element by the wire handle.
Unpack the new element and install into the canister.
Re-install the element hold down bolt, hand tight.
Clean the 'O' ring, and apply a thin coat of your oil. Replace the canister lid and clamp.
Close the drain valve on



the bottom of the absorber canister, and stow the drain hose.
Replace front cover, and close top cover.
Activate the main power source, and then turn **ON** the power switch on the control panel.

After fluid is dispensed through the output hose, shut down the system and check for leaks inside the cabinet.

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Electrostatic Cell Rebuild Program

The Electrostatic Cell in your FPRS™ (Finite Particle Removal System) was designed to provide many hours of superior filtration. Like anything else, it occasionally needs care and maintenance. It is strongly recommended that the Cell be replaced once each year to insure optimum cleaning performance. The re-build/exchange program has been organized to provide minimum downtime and maximum performance.

When you receive your replacement Electrostatic Cell, please note that the red tag affixed to the top of the cell contains part number information, as well as the date the cell was made. A blank area is left open for you to fill in the date the cell was installed in your system. This will help you determine when the cell should be exchanged.

When you are ready to replace your Electrostatic Cell, please follow these steps:

1. Look at the red tag on the top of the cell to locate your part number. (R61CS-115, for example)
2. Send your P.O. to ASL via Phone, Fax, mail, or e-mail (custsvc@aslfilter.com) with the quantity and part number requested.
3. When you receive your cell, install it in your unit, and return the used cell to ASL in the shipping box. (Please backflush the return cell for 10 minutes at 10 psi to drain as much fluid as possible.)

You should order your re-built cells early so you won't be down, waiting for your new Cells to arrive. Please remember to **backflush returned cells** prior to sending them back to us. This will save you on shipping costs, (a re-built cell weighs 16 pounds, and most Returned cells weigh in at 28 pounds) as well as saving the environment, as we have to dispose of the used, contaminated oil and internal components.

Note that if the used cells are not returned to us within 30 days, you will be invoiced separately for a core charge for each cell not returned

If you want to stock spare cells, the 30 day core charge return can be extended.

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WARRANTY INFORMATION

ASL Technologies, LLC, ("ASL") warrants this product to be free from defects in material and workmanship for a period of one (1) year, from date of shipment, excluding expendables, in accordance with the following terms and conditions.

This warranty extends only to the original purchaser ("owner").

This warranty does not include damage to the product resulting from accident, misuse or abuse, improper installation or operation, lack of reasonable care, or unauthorized repair or alteration.

Should this unit fail during the warranty period, ASL will repair or replace it at our option. Replacement products supplied under this warranty may be new or rebuilt at our option. Labor charges will be without cost to the purchaser (owner) during the first ninety- (90) days of the warranty period, up to 500 hours of operation. Owner will be responsible for all labor charges after this period. Owner will pay for the expense of delivering the product to ASL for warranty work, and expense of returning it to the owner after repair or replacement. ASL will assume no field expense for service or parts unless authorized in advance.

This warranty is the only warranty extended by ASL to suppliers and/or purchasers of this product. No other warranty, written or oral, is authorized. ASL disclaims all other warranties; express or implied that arises by operation of law, except that implied warranties of merchantability or fitness for a particular purpose are limited to the duration of the warranty period. ASL shall not be liable for any incidental, consequential or other damage that may have resulted from any alleged breach of warranty, including any cost or expense of providing substitute equipment or service during periods of malfunction or non-use.

Some states do no allow limitation on how long an implied warranty lasts or the exclusion limitation of incidental or consequential damages, so the above stated limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

For instructions on how to obtain warranty service, contact:
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PRODUCT SPECIFICATIONS
FPRS S-Series Cabinet Units

PHYSICAL DIMENSIONS:	
Filter Cabinet:	**26 1/8" High x 19 3/8" Wide x 14 7/8" Deep**
Cabinet Construction:	**14 Gauge Steel**
Water Absorber Canister:	**14 ½" High x 5" Diameter**
SHIPPING WEIGHT:	**125 pounds**
GROSS WEIGHT DRY:	**105 pounds**
GROSS WEIGHT WET:	**121 pounds**
MOTOR: (S-30 & S-40)	**¼ HP 1725 RPM**
	120 VAC 60 Hz, single phase
	4 amps continuous 6 amps start up
MOTOR: 50 Hz Models	**¼ HP 1425 RPM**
PUMP: S-30 & S-40	**30/40 GPH w/100 SUS Fluid @ 1725 RPM**
	1/2" NPT, Inlet & Outlet Ports
WATER ABSORBER:	**5 micron wood/paper element**
	(Mineral Oil Units)
	5 micron nominal synthetic fiber
	(Phosphate Ester Units)
INLET & OUTLET	
CONNECTIONS:	**½" NPT Bulkhead Fittings**
SYSTEM VOLTAGE:	
Input Voltage	**120 VAC 60 Hz, single phase +/- 10%**
Circuit Breaker	**10 Amps.**
Output Voltage of Power Supply	**15KV Nominal 1.9 miliamp (+/-600uA)**

Manufactured in the U.S.A.

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ORDERING SPARE AND REPLACEMENT PARTS

A Spare Parts List for your FPRS is included on the following page. Prompt service can be given for spare or replacement parts if ASL has the following information:

1. The part number(s) of the item(s) you need. The Spare Parts List includes the most frequently requested items.

2. The quantity needed. Please remember to order spares, if needed.

3. Order fulfillment information:

   - ✓ Preferred shipping carrier information (ASL is an On-Line daily UPS shipper)
   - ✓ Ground, Next Day, Second Day, etc.
   - ✓ "Bill To" Address
   - ✓ "Ship To" Address (we cannot ship to a P.O. Box)
   - ✓ Purchase Order Number

Parts will be invoiced F.O.B. Wanatah, IN. at the prices in effect at the time of the shipment. Terms will be Net 30 days. We also accept Visa, MasterCard, and American Express.

Order Address:	**ASL Technologies, LLC** **Parts Department** **10525 W. US Hwy 30, Bldg. 3D** **Wanatah, IN. 43690**
Telephone:	**219.733.2777**
Toll Free:	**888.333.2990**
Facsimile:	**219.733.2779**
E-Mail:	**custsvc@aslfilter.com**
Internet:	**www.aslfilter.com**

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FPRS S-Series Cabinet Spare / Replacement Parts

DESCRIPTION	PART NUMBER
Call ASL for any parts not listed	
High Voltage Power Supply (ALL)	CS-2223-P8
S-40 Pump/Motor/coupler ASSY	ASL-83940-7
S-40 Pump only	00-LEV-040-A-7
S-30 & S-40 Motor only (includes coupler)	88514 (Baldor 60 Hz only)
50 Hz Motor only (includes coupler)	88471 (Baldor 50/60Hz)
Three piece pump to motor coupler (All)	1L519
S-30 Pump/Motor/coupler ASSY	ASL-83930
S-30 Pump only	30-LEV-CC-A-9821 (add –7 for Viton)
Water Absorber Element **Mineral Oil**	WAEB-12
Water Absorber Element **Phosphate Ester**	WAEB-12P
Water Absorber Housing with lid, clamp and ‘O’ ring	ASL-5012
Water Absorber can ‘O’ ring (Buna) (Black)	ASL-397-27
Water Absorber can ‘O’ ring (Viton) (Brown)	ASL-4005
Electrostatic Cell	R61CS-115 (See red tag on top of cell for your exact part number)
Pressure Gauge	ASL-397-23
Lid Safety Switch	07F 038
Lid/Front Cover Magnet	11242
Hour Meter	3311-0000 (50/60 Hz)
Microamp Meter	S13260
S-Series Service Manual (This Manual)	S-Series Cabinet Service Manual
Laminated wiring diagram (Inside front cover)	S-Series-Wiring Diagram
Power Switch	7500K14
Circuit Breaker	4AO45
Green Power Lamp Assy	1052-QC5
Amber Lamp Assy - Backflush	1050-QC3
Red Lamp Assy (Low Voltage, Float Switch, Over Pressure)	1050-QC1
Relay, CR-1 through CR-4	LY2 – 120VAC, 10 Amp contacts
Float Switch	M8700
Pressure Switch	PDA-4-4R4M-C-FL
Remote Alarm Connector	DC68-2-2
Power Cord – 9’	70355 K34
Oil Sample Test Port (Push to test type-Viton)	KP14N-V-1

S-Series Cabinets

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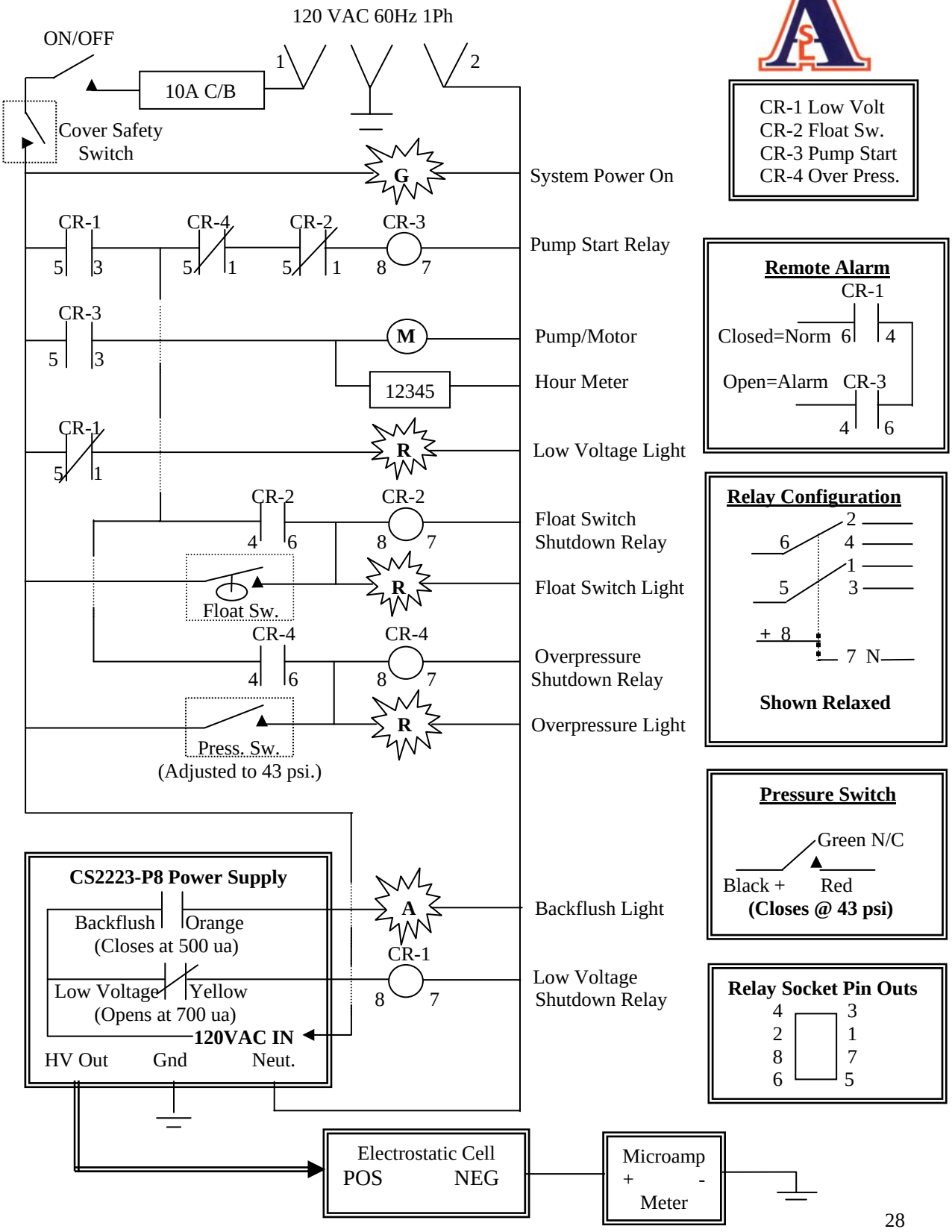
WIRING DIAGRAM S-SERIES CABINET UNITS



CR-1 Low Volt
CR-2 Float Sw.
CR-3 Pump Start
CR-4 Over Press.

Remote Alarm

CR-1
Closed=Norm 6 4
Open=Alarm CR-3
4 6

Relay Configuration

2
6 4
1
5 3
+ 8
7 N

Shown Relaxed

Pressure Switch

Green N/C
Black +
Red
(Closes @ 43 psi)

Relay Socket Pin Outs

4 3
2 1
8 7
6 5

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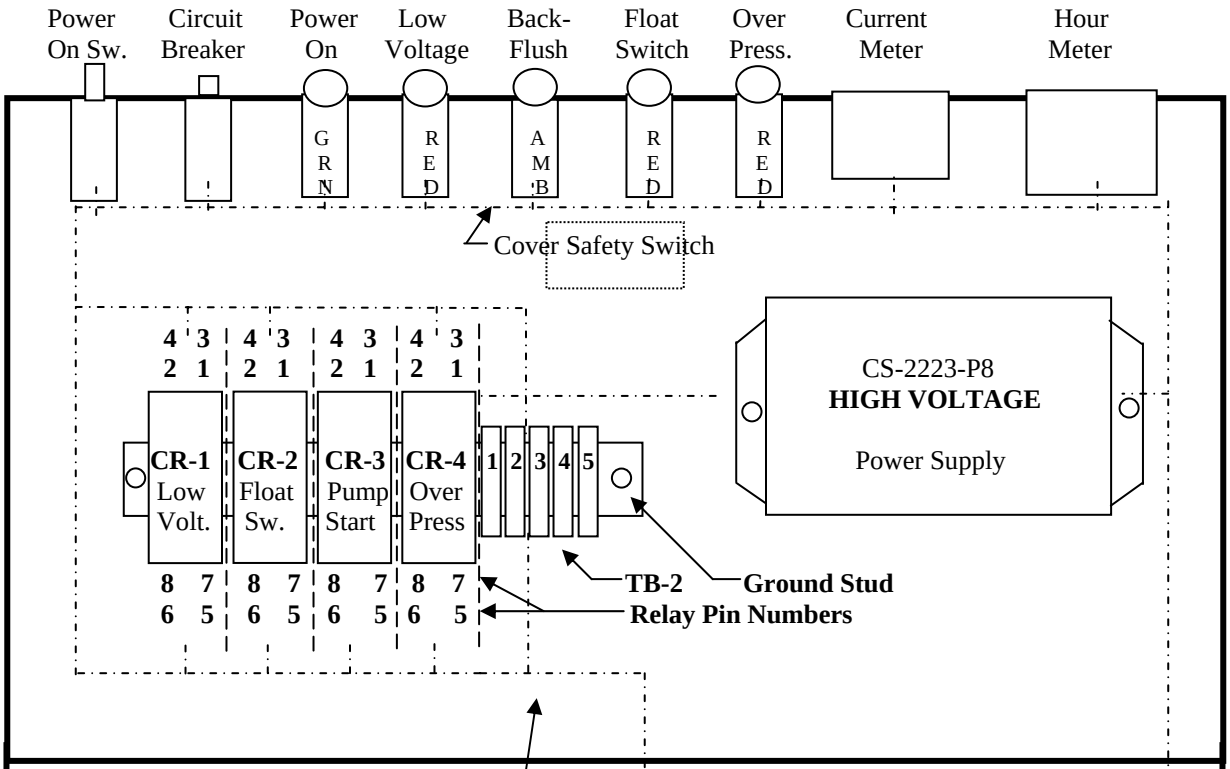
Cover/Cabinet Electrical Component Locations

(Serial Numbers 1007 and Subsequent)



TB-2 Connections:

1: Yellow – To Low Voltage relay
2: Orange – To Backflush indicator
3: Red & Black – Switched 120VAC
4: Black – Incoming 120VAC
5: White - Incoming 120VAC Neutral

Wire Runs
Power/Signal HVDC

TB-1 Connections
H N G Gnd

TB-1 Connections:

H Incoming 120 VAC
N Incoming 120VAC Neutral
G Incoming Ground
Gnd Ground Stud

TB-3 Connections
M N G F SP P

TB-3 Connections:

M: Black – Motor Start
N: White - Neutral
G: Green - Ground
F: Red – Float Switch Fault Signal
Sp: Black – Float & Press. **S**witch **P**ower
P: Red – Press. Switch Fault Signal

To Electrostatic Cell

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MAINTENANCE AND TROUBLESHOOTING

The FPRS system is designed to give years of trouble free service with little attention. The front panel lights, microammeter and system pressure gauge will show signs of trouble, weather caused by contaminant buildup or component failure. The system was designed to make troubleshooting and repair as painless as possible, while providing maximum safety, system protection, and trouble indication. The following theory of operation and troubleshooting guides make reference to drawings and charts located within this manual. Please refer to them to reinforce your knowledge of this product. Remember that ASL Technicians are just a phone call away, should you need any advice or assistance.

ELECTRICAL THEORY OF OPERATION

Refer to the wiring diagram on page 28 (the wiring diagram is also laminated and pasted inside the front cover) The FPRS-S series units use the following wiring conventions:

1. Black wires – 120VAC Power
2. White wires – 120 VAC Neutral
3. Green Wires – Ground
4. Yellow wires – H.V. Power Supply Low Voltage alarm circuit
5. Orange wires – H.V. Power Supply Backflush alarm circuit
6. Blue wires – Remote Alarm Circuit
7. Red wires- 120VAC switched/signal

   Exceptions:

   a. The green wire on the pressure switch is capped and not used, but will have 120VAC present when the pressure switch is open (normal condition)
   b. The float switch comes standard with two white wires pre-installed on the switch. These white wires pass 120VAC through the switch in case of an internal FPRS leak.
   c. The red (pink) hi voltage wire coming out of the right side of the power supply carries 15,000 VDC to the Electrostatic Cell.

THE 120VAC POWER CIRCUIT

120VAC power from the incoming power cord/source, goes first to a 4-position terminal strip on the back wall of the cabinet, (TB-1) located in the upper right corner of the cabinet. H is Hot (black) N is Neutral (white) and G is earth ground (green) From there, power (black wire) runs to another terminal strip located on the inside of the top cover, to the right of the relays. (TB-2 # 4) from TB-2 #4 power then runs to the 10A circuit breaker on the front panel. From the circuit breaker, power is fed to the ON/OFF switch on the front panel. Power then flows to the cover safety switch, and on to TB-2 # 3. Once power leaves the cover safety switch it is called ‘switched power’ or Sp. There are four wires connected to TB-2 #3. One is the incoming ‘switched power’ from the cover safety switch, two goes to the Hi Voltage power supply ‘H’ terminal, three goes to TB-3 on the back wall of the cabinet, above the pump/motor (terminal #Sp) where it splits and sends power to the pressure switch and the float switch, and Four goes to relay CR-3 #5, then to Relay CR-1 #5, then to the green ‘power on’ light. Note that the normally closed contacts of CR1 – 5 & 1 will momentarily pass 120VAC to the red “Low Voltage” light on the front panel. Once the H.V. power supply receives power, a normally closed relay inside the power supply sends power to the coil of CR1, via the yellow wire. The action of CR1 energizing, starts the sequence of events to run the system. Note that as soon as the power supply receives incoming power, 15,000 VDC is immediately applied to the terminals of the Electrostatic Cell!

With CR1 closed, the contacts of CR1-5 &3 close, allowing power to flow through the normally closed contacts of CR4- 5 & 1, and CR2- 5 & 1, thus energizing the coil of CR3. Once CR3 closes, power is allowed to flow through the (now closed) contacts of CR3-5 & 3. Power then simultaneously goes to the hour meter on the front panel and through terminal strip TB-1 to start the

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pump/motor. At the same time CR-1 closes, the normally closed contacts of CR1- 5 & 1 open, turning the red "Low Voltage" light on the front panel off. At this point, the system is operating normally. Green "Power" lamp lit, hour meter running, pump/motor running, 15KV supplied to the Electrostatic Cell.

TROUBLE INDICATING CIRCUITS and TROUBLESHOOTING

LOW VOLTAGE INDICATOR

The red "Low Voltage" light indicates that the Electrostatic Cell High Voltage DC power supply is no longer putting out enough voltage to hold particulate trapped within the Electrostatic Cell. Note that this light will illuminate briefly when power is first turned on.

The low voltage indication is controlled by a normally closed relay within the high voltage power supply. This relay (the yellow wire coming out of the power supply) remains closed until the power supply senses a load of 700 (or more) microamps. At that point, the internal relay opens, and the 120 VAC that was present on the yellow wire drops to zero. This starts a chain of events that commences with the coil of CR-1 relaxing. When CR-1 opens, contacts CR1 – 5 & 3 open, stopping the flow of power to the coil of CR-3, which in turn stops power to the hour meter and pump/motor. At the same time, the contacts of CR1 – 5 & 1 close, allowing power to illuminate the low voltage light.

The idea here is that if the high voltage power supply no longer has enough voltage output to keep particulate trapped within the Electrostatic Cell, the pump needs to be stopped immediately. The backflush procedure depends on this phenomena to operate, i.e. Once power is removed from the cell, contaminant can then be blown out with shop air.

The system will try to keep running, however, and the power supply will reset itself and try to turn on again. If the conditions that caused the low voltage indication are still present, the pump will stop and start as the power supply tries to reset itself. If you observe a "flashing" low voltage light, you should shut down the system immediately and investigate the cause. Remember that the low voltage indicator light should reflect the microamps being consumed, so a low voltage light should be confirmed by observing the microammeter indicating 700 or more microamps.

Causes for a low voltage light. The low voltage light can be caused by one or more of the following:

1. **Shorted Electrostatic Cell**.
   The Electrostatic Cell can short due to ingestion of water, or accumulation of an excessive amount of particulate, particularly ferrous particulate.
   a. Turn power off and un plug the FPRS from the power source.
   b. Using a screwdriver with an insulated handle, short across both POS and NEG terminals of the Electrostatic Cell to dissipate any static electricity.
   c. Remove the red POS spark plug boot/terminal from the Electrostatic Cell.
   d. Remove relay CR-3 to prevent the pump from starting.
   e. Re-connect power, and turn on the power switch. Note that you will have to defeat the cover safety switch to continue. **USE CAUTION**
   f. If the low voltage light is now off, the Electrostatic Cell is shorted, and should be backflushed and/or replaced.
   g. If the low voltage light is on with the Cell disconnected, the power supply is defective and should be replaced.
   h. Note that it is possible to have both a shorted Cell and a bad power supply at the same time. If you have a spare cell, try it first before replacing the power supply.
   i. Note that a defective CR-1 relay and associated wiring can also cause a low voltage indication.

2. **Defective Power Supply**.
If the internal, normally closed low voltage relay in the power supply is defective, a low voltage indication will result. Trouble shoot this failure as follows:

a. Turn power off and un plug the FPRS from the power source.
b. Remove relay CR-3 to prevent the pump from starting.
c. Remove the POS spark plug boot/terminal from the Electrostatic Cell.
d. Restore power to the FPRS and turn the power on. Note that you will have to defeat the cover safety switch to continue. **USE CAUTION**
e. Using an AC voltmeter, check for 120VAC at the "L+ HOT" terminal on the high voltage power supply. (Or terminal 3 on TB-2)
f. If OK, check for 120VAC on terminal 1 of TB-2 (yellow wire)
g. If 120VAC is present at the power supply L+ HOT terminal, and no power is present on the yellow wire, the power supply must be replaced.
h. If 120VAC is present on both the above terminals, check for 120VAC at pin 8 of CR-1. If no voltage present, repair wiring. If 120VAC is present, check for voltage at pin 3 of CR-1. If no voltage present, replace Relay CR-1.
i. Note that all four relays are the same, and can be swapped for troubleshooting purposes.
j. Once repairs are completed, remember to re-install relay CR-3.
k. With respect to the High Voltage DC section, the best way to confirm a "bad" power supply, is to obtain a "times 1000" high voltage probe for your voltmeter. Using the Hi-Voltage probe plugged into the red spark plug terminal/boot, a properly operating power supply will indicate 15.00 to 16.00 VDC (15,000 to 16,000 VDC) Defective power supplies will read "0" to 4 KVA.
l. The number one reason for power supply high voltage section failure is operating the Electrostatic Cell beyond one year. (8700 hours)

BACKFLUSH INDICATOR (AMBER)

Backflushing of the Electrostatic Cell in your unit is unique to the FPRS system. Backflushing the contaminates out of the cell allows for much longer filtration life than with conventional mechanical filters.

The amber "backflush" light is controlled directly by the high voltage power supply orange wire. A normally open relay, inside the high voltage power supply, closes when the power supply senses 500 microamps. As shown on the wiring diagram, once the internal relay closes, the amber backflush light receives power directly.

A backflush light should always be confirmed by observing the microammeter reading of approximately 500 microamps. Note that the microammeter is connected between system ground and the NEG terminal on the Electrostatic Cell. The orange wired backflush relay inside the power supply also senses 500 microamps, and lights the light, but in a different manner.

Under normal circumstances, when the backflush light comes on, and the microammeter reads 500 microamps, it's time to backflush the cell, in accordance with the Backflush procedure on page 20 of this manual.

A backflush light on, with a low microammeter reading, most likely indicates a defective power supply relay, sensing circuit, or a defective microammeter. In troubleshooting, if you "jumper" in a spare microammeter, note that the "+" on the meter goes toward the Electrostatic Cell.

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The opposite case of a microammeter reading 500, with no accompanying backflush light, should be troubleshot as follows:

1. Secure power to the FPRS.
2. Open the cover and locate the orange wire on terminal 2 of TB-2.
3. Turn power on. Note that you will have to defeat the cover safety switch to continue. (**USE CAUTION**)
4. Using a voltmeter, check for 120VAC on the orange wire. If 120VAC is present, replace the amber backflush lamp assy. Note that all of the indicator lights are of the "non-relampable" type, and must be replaced completely.
5. If 120VAC is not present on the orange wire, the power supply is defective.

FLOAT SWITCH INDICATOR (RED)

The float switch prevents an internal FPRS leak from draining the reservoir and is designed to be a "non-resetting" safety fault. The float switch itself is located in a bracket on the drip tray in the bottom of the base cabinet in the right rear corner, behind the Cell. In case of a fluid leak, the float switch will slowly rise on the fluid until the internal magnetic contacts close. Once these contacts close, several things happen at once.

When the contacts of the float switch close, power, which has been sitting on one side of the switch, is allowed to travel to the red float switch light, the coil of CR-2 and contact CR2 – 6. Once CR-2 is energized, the normally closed contacts of CR2 -5 & 1, open, stopping the flow of power to the coil of CR-3. When CR-3 opens, power is removed from the pump and hour meter. The wire coming back down from CR1 – 3, provides power through the (now closed) contacts of CR2 – 4 & 6, keeping the red float switch light on, and the coil of CR-2 closed.

Thus, even though the float switch may only "bump" closed momentarily, the red light and fault will remain "latched" on until an operator intervenes.

If a red "float switch" light is observed, immediately investigate the source of the leak and make any necessary repairs. To reset the fault, turn power off, and then back on.

This circuit can be tested by intentionally closing the float switch, and observing that the light illuminates, and the pump and hour meter stop. Opening the switch will not reset the light, or start the motor.

Troubleshooting this circuit is straightforward. The only components are the float switch itself, relay CR-2, and the associated wiring.

OVERPRESSURE (RED)

The overpressure light circuit in the FPRS-S series units is wired differently than earlier ASL "ABH" or mobile cart units. In the S series units, the overpressure is utilized as an absolute upper pressure limit, and will shut the unit down when activated. Like the float switch fault, the over pressure fault is a latching, non-resetting fault.

As stated elsewhere in this manual, the bypass relief valve on the pump in your FPRS unit is adjusted at the factory so that the pump will be in "full bypass" at approximately 40 psi. If for some reason the bypass relief valve in the pump should fail, system pressures could rise drastically very quickly. The pump is easily capable of pressures exceeding 200 psi. Such a sudden pressure rise, if not checked, could blow the seals in the Electrostatic Cell, water absorber canister, and rupture hoses within the system, causing significant equipment damage and/or personnel injury.

The pressure switch, located just below the test port, is adjusted at the factory to close at approximately three to five psi higher than the pump bypass relief valve, i.e. 43 to 45 psi.

When the contacts of the pressure switch close, power, which has been sitting on the black wire, is allowed to travel through the red pressure switch wire to the red overpressure light, the coil of CR-4 and contact CR4 – 6. Once CR-4 is energized, the normally closed contacts of CR4 -5 & 1, open, stopping the flow of power to the coil of CR-3. When CR-3 opens, power is removed from the

pump and hour meter. The wire coming back down from CR1 – 3, provides power through the (now closed) contacts of CR4 – 4 & 6, keeping the overpressure light on, and the coil of CR-4 closed.

Thus, even though the pressure switch may only "bump" closed momentarily, the red light and fault will remain "latched" on until an operator intervenes. Cycle power off – then on.

As designed, when the overpressure circuit is operating properly, it indicates a failure of the pump assembly and/or the pump relief valve. Repairs on the pump should only be undertaken by experienced hydraulic pump repair persons. New/spare pumps can be purchased through ASL.

Troubleshooting this circuit is straightforward. The only components are the pressure switch itself, relay CR-4, and the associated wiring. See the "Removal and Replacement of Components" section, starting on page 36.

MICROAMMETER

The microammeter, located on the front panel between the elapsed time meter and the over pressure light, indicates, in micro-amps, how much current the Electrostatic Cell is pulling from the high voltage power supply. The microammeter shows the general condition of the cell and is a good way to predict impending maintenance actions.

As stated previously in this manual, the microammeter has two readings that are related to two indicator lights on the front panel.

1. At approximately 500 microamps, the amber "Backflush" light will light, indicating that Electrostatic Cell backflush is required. Shut down the system and backflush the Cell in accordance with the instructions on page 20 of this manual. Note that under normal operating conditions, the microammeter will rise slowly toward 500, giving maintenance adequate warning that backflush time is approaching. Note that the system will continue to operate beyond 500 microamps, all the way up to 700 microamps, when the "Low Voltage" light comes on, and the system shuts down. Operation above 500 microamps for any extended period of time is not recommended, and the cell should be backflushed or replaced as soon as practical.
2. At approximately 700 microamps, the red "Low Voltage" light will come on, and the system will shut down. Unless the reservoir is suddenly flooded with water, or the high voltage power supply fails, you should never see the Low Voltage light come on, other than one or two seconds at initial power-up of the system.

The microammeter on your FPRS system should be checked frequently. When the system is new, and the oil in your reservoir is clean, microamp readings will be low. Normally, the meter will climb very slowly over time, and may take months to reach 500. On other systems, the meter could start at 200 and slowly climb, or even go down over time. The main thing to watch for is erratic movements, rapid climbing, etc.. A rapid climb most always indicates water has entered the system, and finding and correcting the source of the water intrusion should be paramount. Once water has entered the Electrostatic Cell, concentrations of 600 ppm and higher, will short it out rapidly. Replacement of the water absorber and Backflushing the Electrostatic Cell (perhaps several times) will restore proper operation.

Changes in microammeter readings will also occur under the following fluid conditions:

1. **HEAT** – Current Increases. Fluid temp. will cause the uA to increase. A rise from 80°F to 110°F can sometimes double the uA. In turn, as fluid temp. decreases, so will the uA.
2. **COOLING** – Current decreases.
3. **WATER** – Water can make the "base current" appear higher than it really is.
4. **VARNISH** – Although the Electrostatic Cell is capable of capturing a lot of varnish before it will effect the operation of the Cell, at some point, as the oil oxidizes, varnish will cause the efficiency of the cell to decrease, and the Cell will need to be replaced.

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ELAPSED TIME METER

The elapsed time indicator on the front panel reads in hours and hundredths of hours. The meter is very accurate and reads to 99,999.99 hours. (Over 11 years) There are hundreds of ASL systems in the field with 70 and 80 thousand hours on the clock.

The meter runs on 120 VAC 60 cycle, single phase power, which comes from CR3 – 3. This relay contact also supplies power to the pump/motor assembly. Hence, the meter only runs when the pump is receiving power.

In troubleshooting a defective hour meter, with the system running, check for 120VAC power at relay CR3 – 3, if no voltage present, the pump is not running either. If voltage is present, and the pump is running, check for power at the red wire on the back of the meter. If voltage is

present (check the white neutral also) replace the meter. If voltage is not present, check the wire running from CR3 –3 to the meter. Note that two wires are installed on CR3-3, black goes to the pump, and red goes to the meter.

If the pump and motor AND the meter are not running (no other abnormal system indications) check for 120VAC at the coil of CR3 – 8. If voltage is present, there should be power on CR3 – 3. If no voltage on CR3 –3, replace the relay. If no voltage present on the coil of CR3 – 8, trace backwards to CR2 – 1, CR2 – 5, CR4 – 1, CR4 – 5, CR1 – 3. CR1 – 5. Refer to the wiring diagram on page 28 of this manual.

REMOTE ALARM CIRCUIT

The remote alarm circuit consists of two sets of “dry” contacts in relays CR-1 and CR-3. CR1 – 6 & 4, are closed during normal operation, as are CR3 – 4 & 6. Two wires lead out to a two pin male “spade” connector, which accepts .250 inch female spade terminals. This connector is located on the right side of the cabinet, just below the power cord.

During normal operation, these two pins will have continuity between them, and are for customer interface with an outside indication or warning system such as a PLC. When attaching an external system, do not exceed 24 VDC.

Thus, any problem that stops the power supply (CR-1) or the Pump (CR-3) will cause an open between the two remote alarm contacts.

PUMP/MOTOR ASSEMBLY

The pump and motor assembly used in your FPRS is designed for continuous duty, and will give many years of trouble free service. For your convenience, the pump manufacturers service manual is located in the last section of this manual, starting on page 45. The pump and motor consists of three basic parts which are all easily field replaceable. The pump itself is attached to the motor housing with 3 ¼ -20 x ¾” long bolts and lock washers.

Coupling the pump to the motor is a three piece tang coupler which consists of two hard plastic splines and a center metal adapter. Note that the pump shaft has the “male” tang and the motor shaft is the female end. Replacement of the pump or coupler is straightforward, and should present no problem for maintenance. See the following section for removal and replacement of the pump, along with required adjustments.

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REMOVAL AND REPLACEMENT OF COMPONENTS

Front Panel Indicator Lights
These lights are the "non-relampable" type, and are a "snap-fit" into the top cover. Remove the two .186 spade connectors, and compress the tangs on the sides of the lamp using thumb and forefinger. Push the lamp from the back out through the front cover. Replacement lights are available from ASL.

Microammeter
The microammeter is a special Simpson DC Microamperes design. Using a meter not intended for your FPRS is not recommended and could result in damage to the equipment. To replace the meter, remove the two 5/16" nuts which secure the green wires to the back of the meter. Using a ¼" nut driver, remove the four nuts and lockwashers securing the meter to the cover. Push the meter out from the back to the front. Install the new meter (make sure it's right side up) and secure the four ¼" nuts/lockwashers, taking care not to over tighten. Re-install the wiring to the two posts, making sure that the wire on the "+" terminal goes toward the Electrostatic Cell.

Hour Meter
The hourmeter is held in place with two 6-32 screws and locknuts. Remove the two spade wiring terminals from the meter by pulling straight up. Remove and retain the attaching screws and nuts. Remove the meter by pushing it out from back to front. Install the new meter (make sure it's right side up) using the retained screws and nuts, and re-attach the spade terminals.

Hi Voltage Power Supply
Secure power to the FPRS before replacing the power supply.

1. Using an insulated screwdriver, short across the POS and NEG terminals of the Electrostatic Cell to dissipate any static electricity.
2. Using one hand, remove the POS terminal from the Electrostatic Cell.
3. Cut all ty-wraps securing the POS and NEG leads from the cell to the power supply.
4. Remove the 8- inch long wiring trough cover to the left of the power supply.
5. Locate the two-pin connector for the Yellow and Orange wires coming from the power supply, and disconnect it by pulling the two halves apart.
6. Pull the three spade connectors (Power, Neutral and Ground) from the power supply.
7. Remove the two 6-32 nuts and washers from the studs, and remove the power supply from the unit. Note that the red high voltage lead and spark plug terminal/boot remain attached to the power supply.
8. Install the new power supply in the reverse order. Note that replacement power supplies have a relatively long Positive lead with the boot and terminal installed at the factory. Take care when coiling up the excess length to tie it out of the way of the cover and cover magnets.
9. Plug in the three spade connectors to the power supply, observing wire color codes and power supply connector labels. Red wire to HOT +, Green wire to GND, and white wire to HOT -. Connect the two pin yellow/orange connector to the harness, and re-install the wire trough cover.

Electrostatic Cell
See page 21 in this manual.

Water Absorber Element
See page 22 in this manual.

Pump/Motor COMBINATION
Replacement of the pump and motor is straightforward. The pump/motor is secured to studs in the back of the cabinet with four ¼-20 locknuts and flat washers. For ease of access, the Electrostatic Cell should be removed. Secure power to the unit before any servicing.

1. Start by removing the motor wiring box cover and disconnecting the wire nuts tying the SO cord to the motor leads. The green ground wire is secured with a green screw to the motor inside the motor wiring box. Pull the SO cord out of the motor wiring box and plastic "Heyco" connector. Note that wire connections and numbers are located on the motor nameplate, as well as page 44 of this manual.
2. The hose connections to the motor are of the "push-lock" type, and will have to be cut. Slit the inlet and outlet hoses the minimum amount necessary to allow removal of the hoses from the push-lock fittings. Trim the hose ends square for re-installation. Excessive slitting and /or trimming will render the hoses too short, and they will have to be replaced. There is enough excess hose length to remove and replace the pump at least once or twice.
3. With the wiring and hoses disconnected, remove the four ¼-20 nuts and washers, and remove the pump/motor assembly from the cabinet.
4. With both the old and new pumps/motors on the workbench, transfer the inlet/outlet hose fittings and the black "Heyco" wiring fitting to the new pump/motor. Take care to align the fittings the same way they were. Use a suitable thread sealer on all pipe threads.
5. Install the pump/motor into the cabinet by reversing the above instructions. A drop of lubricant on the push-lock fittings will ease installation of the hoses.
6. Secure all wiring and hoses and proceed to "**PUMP and PRESSURE SWITCH ADJUSTMENTS**" on page 39.

Replacement of PUMP only
If you have determined that only the pump needs to be replaced, the motor and it's electrical connections can remain attached to the cabinet.

1. Remove the pump inlet and outlet hoses. The fittings are of the "push-lock" type, and the hoses must be cut. Slit the inlet and outlet hoses the minimum amount necessary to allow removal of the hoses from the push-lock fittings. Trim the hose ends square for re-installation. Excessive slitting and /or trimming will render the hoses too short, and they will have to be replaced. There is enough excess hose length to remove and replace the pump at least once or twice.
2. Remove the three ¼-20 bolts and lock-washers securing the pump to the motor.
3. Separate the pump from the motor by pulling straight up on the pump body while rotating the pump.
4. There is a three-piece coupler connecting the pump to the motor. During pump/motor separation, one or more of these coupler pieces may come out with the pump. Carefully inspect the three-piece coupler for signs of wear or damage. The coupler should be replaced if found defective. Note that a new coupler is included with a replacement motor, and a pump and motor combination, but not with a replacement pump. Before ordering a replacement pump, determine if the coupler will need to be replaced, so it can be ordered at the same time. It is a good idea to replace the coupler when replacing either the pump or the motor.

5. With the old and new pumps on the workbench, transfer the inlet and outlet fittings to the new pump. Take care to align the fittings as they were. Use a suitable thread sealer on all pipe threads.

6. Install the plastic female tang coupler and the metal center section coupler pieces on the motor shaft. Install the male tang coupler piece on the new pump.
7. Using a twisting motion, install the pump onto the motor, taking care to align the splines of the couplers. Once aligned, the pump will "drop" into position.
8. Re-install the three ¼-20 bolts and lock-washers thru the pump to the motor**. Note that these bolts are ¾" long. Longer bolts will bottom out.**
9. Re-install inlet and outlet hoses. A drop of lubricant on the push-lock fittings will ease installation of the hoses.
10. Proceed to "**PUMP and PRESSURE SWITCH ADJUSTMENTS**" on page 39.

Replacement of MOTOR only

If you have determined that only the motor needs to be replaced, the pump and its attached hoses can remain in the cabinet.

1. Start by removing the motor wiring box cover and disconnecting the wire nuts tying the SO cord to the motor leads. The green ground wire is secured with a green screw to the motor inside the motor wiring box. Pull the SO cord out of the motor wiring box and plastic "Heyco" connector. Note that wire connections and numbers are located on the motor nameplate, as well as page 44 of this manual.
2. Remove the three ¼-20 bolts and lock-washers securing the pump to the motor.
3. Separate the pump from the motor by pulling straight up on the pump body while rotating the pump.
4. There is a three-piece coupler connecting the pump to the motor. During pump/motor separation, one or more of these coupler pieces may come out with the pump. Carefully inspect the three-piece coupler for signs of wear or damage. The coupler should be replaced if found defective. Note that a new coupler is included with a replacement motor, or pump and motor combination, but not with a replacement pump.
5. With the pump and motor separated and the wiring removed, remove the four ¼-20 nuts and flat washers securing the motor to the cabinet studs and lift the motor out of the cabinet.
6. Transfer the black "Heyco" wiring fitting and locknut to the wiring box of the new motor.
7. Install the plastic female tang coupler and the metal center section coupler pieces on the new motor shaft. Install the male tang coupler piece on the pump.
8. Install the new motor onto the cabinet studs and secure with four ¼-20 locknuts and flat washers.
9. Using a twisting motion, install the pump onto the motor, taking care to align the splines of the couplers. Once aligned, the pump will "drop" into position.
10. Re-install the three ¼-20 bolts and lock-washers thru the pump to the motor. Note that these bolts are ¾" long. Longer bolts will bottom out.
11. Re-install the SO cord through the "Heyco" fitting and re-connect wiring in accordance with the diagram on page 44 of this manual.
12. Tie up any loose wiring and return the unit to service. Note that pump adjustments should not be required when replacing the motor only.

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Pressure Switch Replacement
Replacement of the pressure switch will normally never be required, due to the fact that correct operation of the switch will occur only after failure of the pump by-pass and system pressure has exceeded 43 to 45 psi. There are other instances that could cause illumination of the overpressure light, such as "back-feed" pressure from the outlet side, which could be caused by incorrect installation. Adjustment of this switch, however, is critical and will be required following replacement of the pump or the pressure switch. Replacement of this switch is straightforward, and only requires un-screwing it from the water absorber inlet manifold, and connecting the black and red wires. The green wire is not used, and should be capped.
Following pressure switch replacement, proceed to the "**PUMP and PRESSURE SWITCH ADJUSTMENTS**" below.

PUMP and PRESSURE SWITCH ADJUSTMENTS
The following procedure should be followed after replacement of the pump and/or pressure switch. Note that these adjustments are **CRITICAL** to proper system operation and should be read and understood before continuing.

WARNING – This procedure will involve temporarily raising system pressures to higher than normal levels. Care should be taken to avoid gross over-pressurization of the system. This procedure will also require that the cover safety switch be defeated. Maintenance personnel are cautioned to take extra care when operating the system with the covers removed. Refer to the pump vendor service manual, starting on page 45 of this manual.

1. Start system and wait until output flow is observed.
2. Remove the acorn nut on the pump relief valve. (5/8" for S-30, 11/16" for S-40)
3. Insert a screwdriver into the slot of the adjusting screw and hold it steady.
4. Loosen the 7/16" locking nut with a wrench by turning counterclockwise.
5. Slowly close the throttling ball valve above the pressure gauge until the system pressure is at 50 psi. If the pressure fails to reach this level with the throttling valve closed, turn the adjusting screw inward (clockwise) until the desired pressure is reached. (Adjusting clockwise raises the pressure setting).
6. If the pressure reaches 50 psi before the throttling valve is completely closed, turn the adjusting screw outward (counterclockwise) until 50 psi is reached. (Adjusting counterclockwise lowers the pressure setting).
7. The pressure switch may close during the above adjustment, shutting the system down with an "Over Pressure" fault. If this happens, remove the 1/8 inch Allen lock screw from the pressure switch and set aside. The pressure switch adjustment is also a 1/8 inch Allen, and can be adjusted after removing the lock screw. Turn the pressure switch adjustment clockwise to raise the switch closing point above the pump by pass setting.
8. Once the by-pass is set at 50 psi. with the throttling valve closed, open the throttling valve for a few minutes to let the system flow. Operation with the pump in full bypass for long periods will cause excessive heat buildup and could cause damage to the pump.
9. Slowly close the throttling valve until the pressure gauge reads approximately 43 to 45 psi. Adjust the pressure switch slowly counterclockwise until the system shuts down
10. Open the throttling valve and re-start the system.
11. Slowly close the throttling valve while observing the pressure gauge until the system shuts down. The system should shut down with the "Over Pressure" fault at approximately 43 to 45 psi. Repeat the pressure switch adjustment, until the switch closes at approximately 43 to 45 psi.

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12. Open the throttling valve and re-start the system. Slowly close the throttling valve until the pressure gauge reads **40 psi.** Turn the pump by-pass adjusting screw counterclockwise until the pressure just begins to drop. Tighten the nut to lock the setting in place.
13. Open the throttling valve for a few minutes, and then slowly close it fully. Observe that the system pressure stays at 40 psi. with the throttling valve fully closed. Re-adjust if necessary.
14. Once all adjustments are complete, open the throttling valve completely and replace the acorn nut on the pump by-pass valve and the 1/8 inch Allen lock screw in the pressure switch.

SCHEDULED MAINTENANCE TASKS

The following is a recommended scheduled maintenance plan, which is intended to provide maximum performance from your FPRS unit.

DAILY

1. Check that green "Power" lamp is illuminated.
2. Check that pump/motor and hour meter are running,
3. Check system pressure gauge below 35 psi.
4. Check Microammeter below 500 microamps.

WEEKLY

1. Leave the "Power switch" in the "ON" position, open the top cover and observe that the unit shuts down.
2. Check for any internal leaks.
3. Check for loose relays, wiring and connections for security.
4. Close the top cover and observe that the unit re-starts.
5. Perform the daily checks after the unit has re-started.

MONTHLY

In addition to the weekly checks above, perform the following additional checks:

1. Using a soft cloth, wipe down the exterior surfaces of the cabinet. The static electricity forces at work inside your FPRS unit will attract dirt and dust from the air around the unit. Pay particular attention to the cooling vents on the bottom and back of the cabinet, as well as the motor end bell and motor cooling fan.
2. Inspect the inlet and outlet fluid hoses for signs of leaks or deterioration.
3. Inspect the power cord for evidence of wear or fraying.

YEARLY

In addition to the monthly checks above, perform the following additional maintenance actions and checks:

1. Replace the Electrostatic Cell. Even though the system appears to be operating properly, the Electrostatic Cell should be replaced on an annual basis due to internal wear, which can cause arcing and deterioration.
2. Replace Water Absorber element. This throw away element, although designed primarily to entrap free and emulsified water, will also trap larger particulate, and should be replaced at least once each year.

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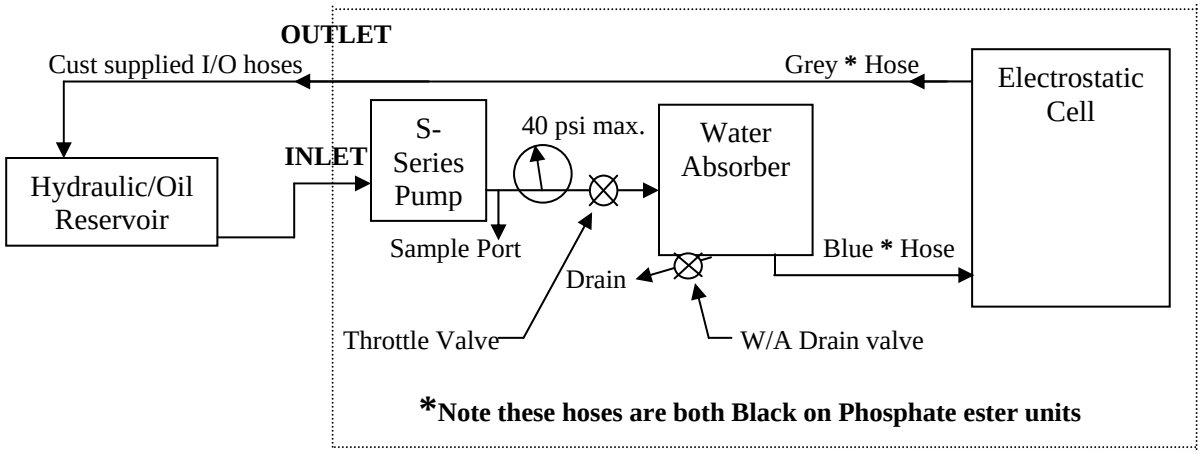
FPRS S-SERIES CABINET FLUID FLOW DIAGRAM



S-Series Cabinets

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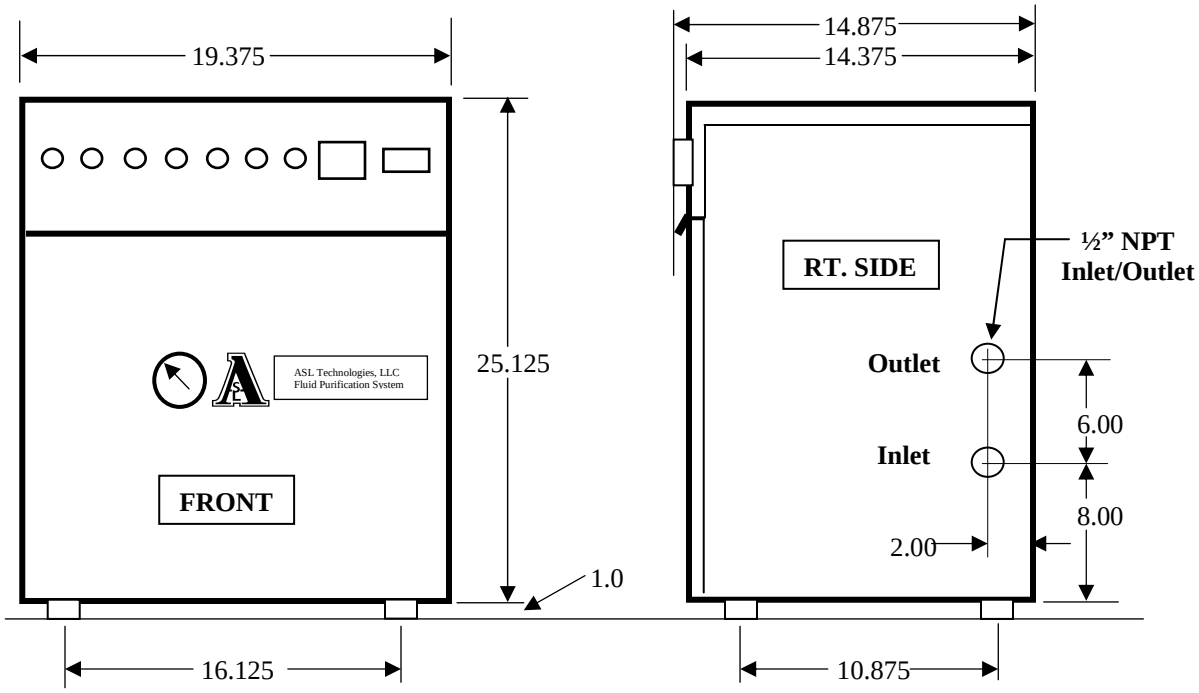
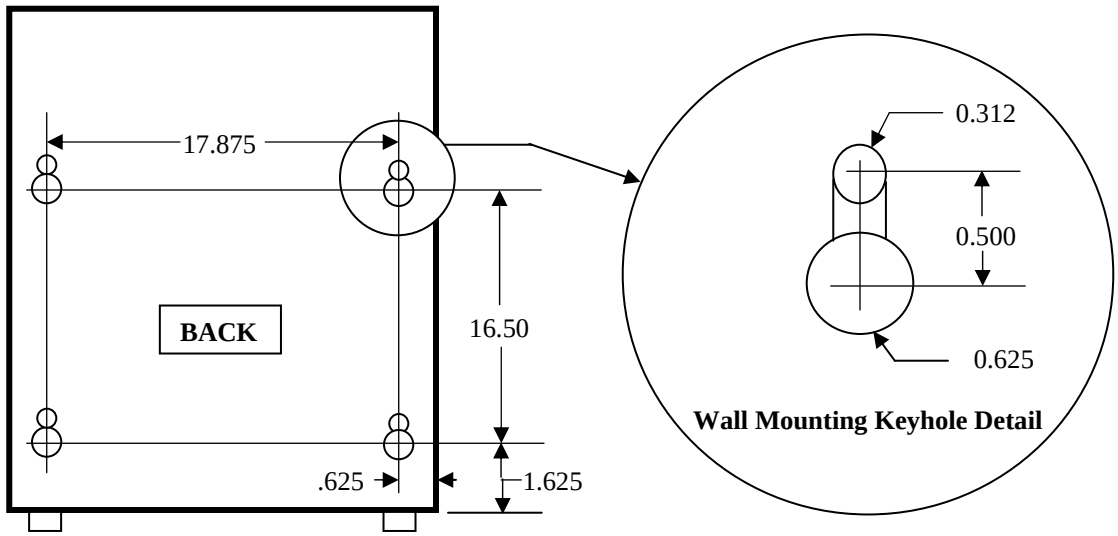
S-Series Cabinet Dimensions

(Not to Scale)

(See next page for Lid open dimensions)





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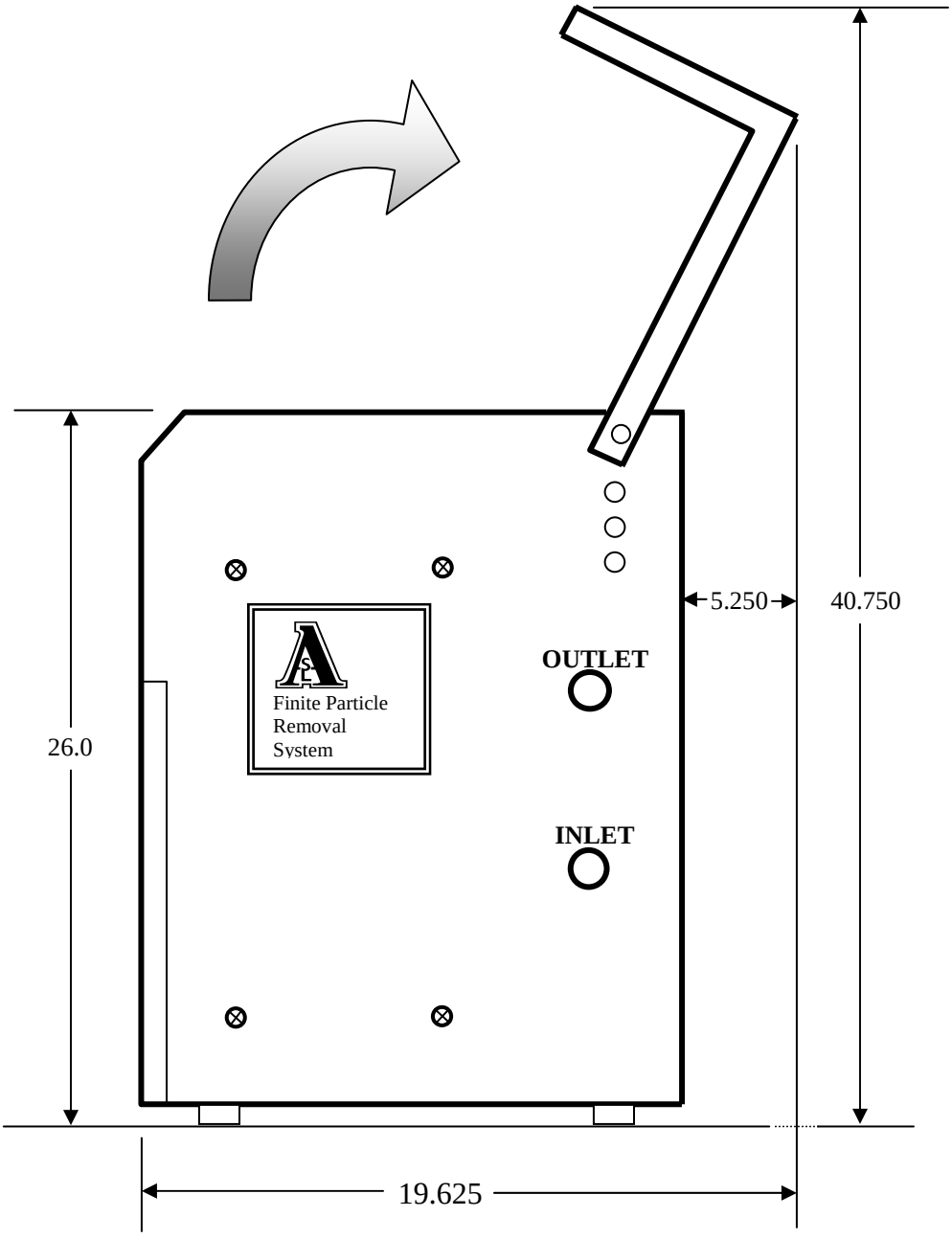
"S" Cabinet Units Right Side View Lid Open Dimensions

(Not to scale)



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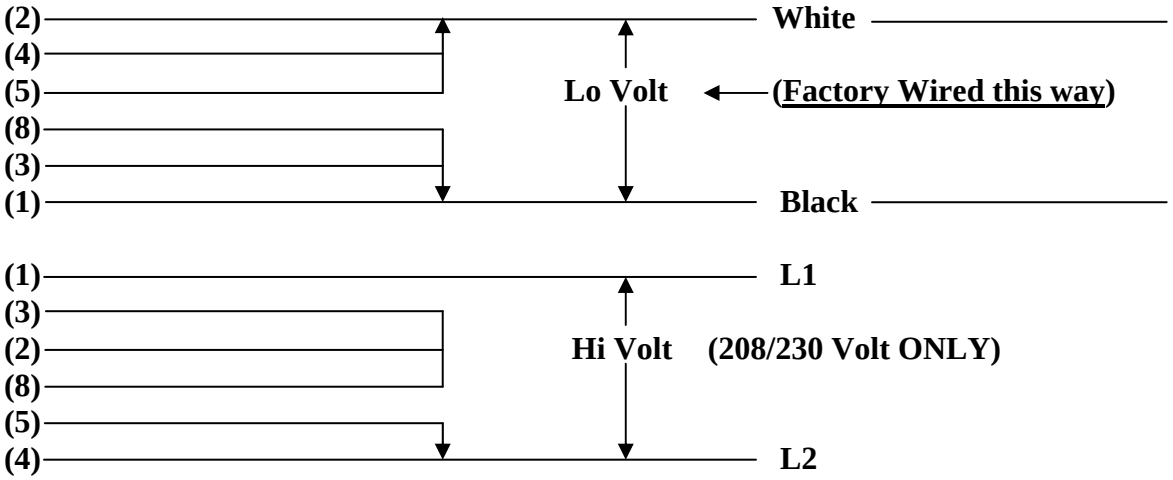
Motor Service Data
Nameplate Data, P/N 88514
(Grey Baldor Motor S-30 & S-40 Only)

Model: 34G510-5506	P/N: 88514	
Volts: 115/208-230	Hz: 60	KVA Code: L
H.P.: ¼	FR: 48 YZ	Phase: 1
RPM: 1725	SF: 1.35	ENC: TEFC
FLA: 5.0/2.6-2.5	Max Amb. 40°C 104°F	INS: B
SFA: 5.6/3-2.8	Time Rate: Cont. Duty	Baldor Motors
NEMA Eff: 55%	PF: 57%	

Motor Wiring Data (Grey Baldor Motor Only)
(Motor is ASL Factory wired <u>Lo Volt CW Rotation</u>)



<u>Do not reverse rotation!</u>

The following pages contain the Installation and Service Instructions for the Tuthill L Series pumps. The model used in the ASL-FPRS-S40 Cabinet is 00LEV-040-CC-A. S-30 units use 30-LEV-CC-A-9821. The manual is reprinted with permission from the Tuthill Pump Group.

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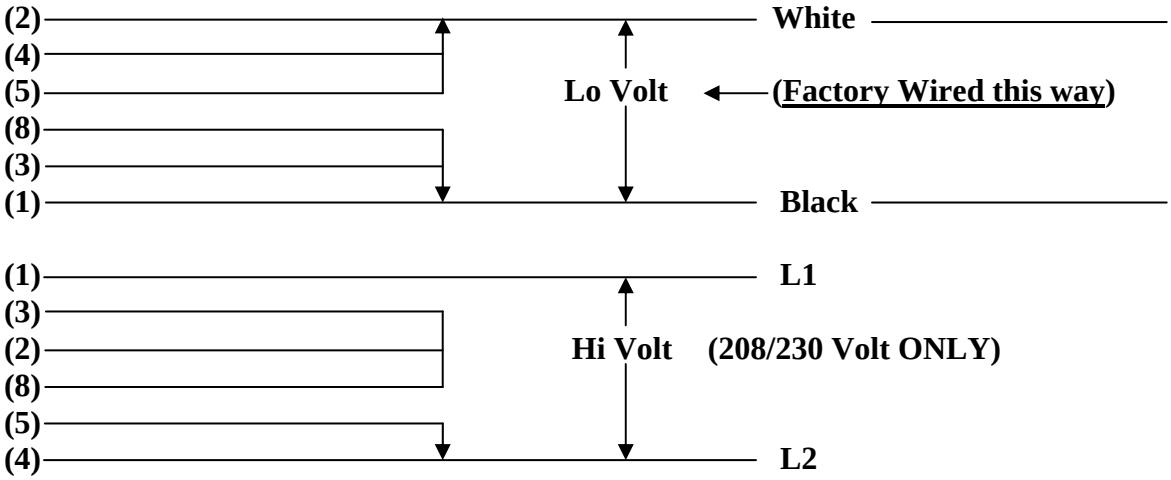
Motor Service Data
Nameplate Data, P/N 88471 (50Hz)
(Grey Baldor Motor S-30 & S-40 Only)

Model: 34G510W773G1	P/N: 88471	
Volts: 115/230	Hz: 50/60	KVA Code: L
H.P.: ¼	FR: 48 YZ	Phase: 1
RPM: 1725/1425	SF: 1.35	ENC: TEFC
FLA: 5.0/2.6-2.5	Max Amb. 40°C 104°F	INS: B
SFA: 5.6/3-2.8	Time Rate: Cont. Duty	Baldor Motors
NEMA Eff: 55%	PF: 57%	

Motor Wiring Data (Grey Baldor Motor Only)
(Motor is ASL Factory wired <u>Lo Volt CW Rotation</u>)



<u>Do not reverse rotation!</u>

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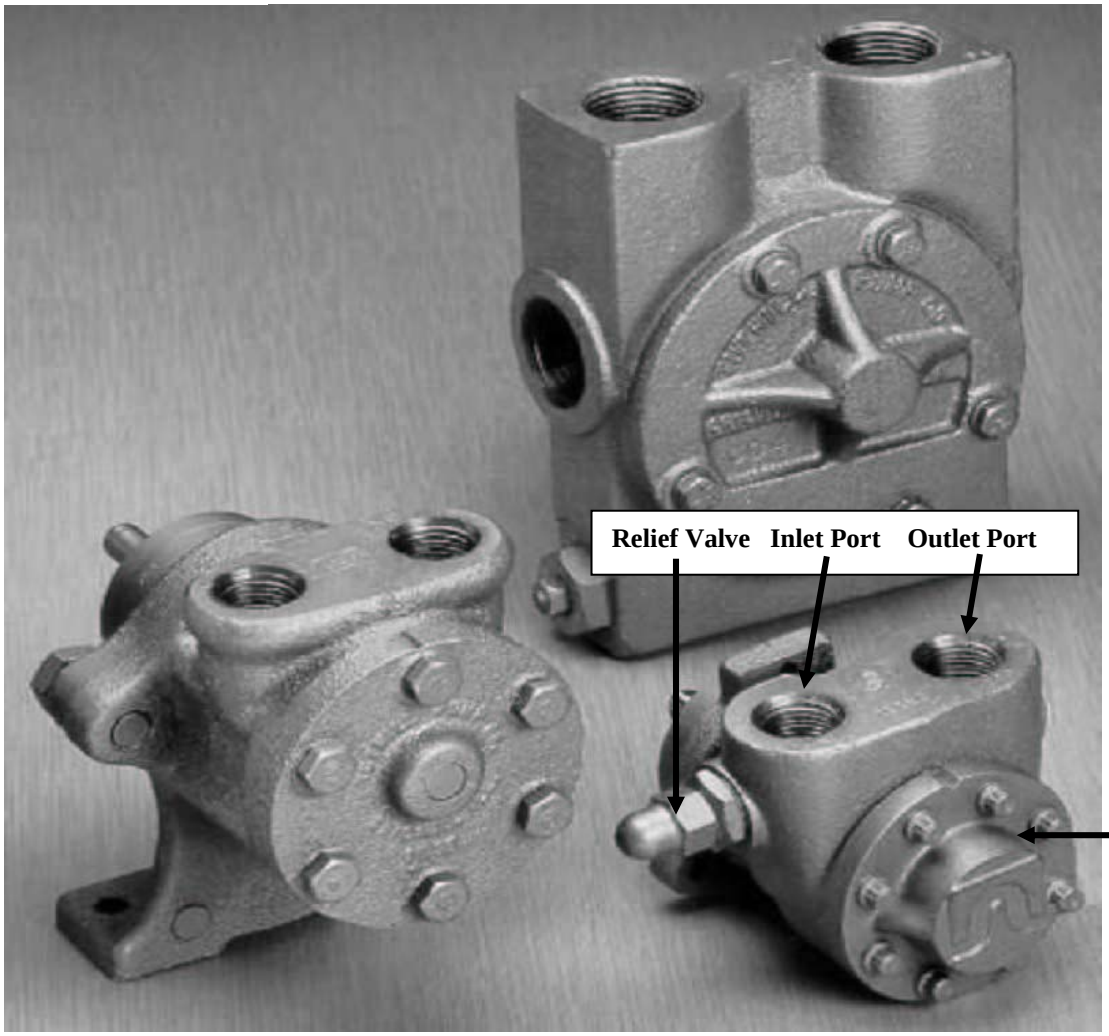
Installation and Service Instructions
L Series Pumps



S-40 = 00-LEV-040-CC-A S-30 = 30-LEV-CC-A-9821

General Description

Tuthill's LA and LE Series are compact, highly efficient, cast iron positive displacement rotary gear pumps with a mechanical seal. Built in six sizes, they provide nominal capacities from .5 to 14 gallons per minute and pressures up to 500 psi (300 psi in the 5LE). They are self priming and particularly suited to handle liquids of 35 to 1000 SSU viscosity. Higher viscosities can be handled at reduced speeds.

The LA Series is supplied with a two bolt flange, the **LE Series with a three bolt flange**. Optional mounting feet are available for both Series. **An internal relief valve is an option with the LE Series**. Both Series are bi-rotational (**unless outfitted with a relief valve**) and designed for direct drive at standard motor speeds, with modifications available for indirect drive.

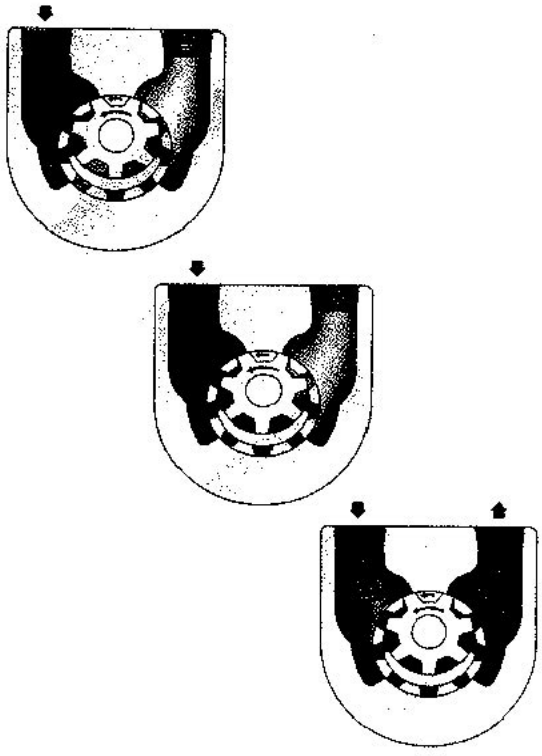
The Pumping Principle

Tuthill's LA and LE Series employ the internal gear pumping principle. There are only two moving parts. Pumping action is based on a rotor, idler gear and crescent-shaped partition cast integral with the cover.

Power applied to the rotor is transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler and the inside diameter of the rotor is sealed by the crescent.

As the pump starts, the teeth come out of mesh, increasing the volume. This creates a partial vacuum, drawing the liquid into the pump through the suction port.

The liquid fills the spaces between the teeth of the idler and the rotor and is carried past the crescent partition through the pressure side of the pump.



When the teeth mesh on the pressure side, the liquid is forced from the spaces and out through the discharge port.

WARNING

Failure to follow these instructions could result in serious bodily injury or death.

These pumps should **not** be used for handling plain water, corrosive or abrasive liquids or liquids not possessing adequate lubricity.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

All Tuthill pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.

Location

LA and LE Series pumps are designed for working pressures up to 500 psi (300 psi in the 5LE) and are required to develop 25" mercury vacuum at 0 psi on factory test. While these pumps will develop as high as 27" of vacuum, it is a sound engineering practice to avoid extreme vacuum whenever possible. Select a pipe size to reduce line friction loss to a minimum.

The pump should be located as close to the source of supply as conditions permit and if possible, below the level of the liquid in the reservoir. When necessary to locate the pump in a pit, provisions should be made to safeguard against flooding. Care must be taken to properly support the suction and discharge piping so that no strain is put on the pump due to either weight or expansion. Piping strain can result in misalignment, hot bearings, worn couplings, and vibration. It is important that the piping used be clean and free of chips or scales.

Proper Installation

Unsatisfactory pump installations are usually characterized by poor suction conditions for the specific liquid being handled. Suction conditions should be minimized to prevent vaporization of the liquid. If vacuum conditions force the liquid to vaporize, cavitation will occur, resulting in loss of capacity, premature wear and noisy operation.

When handling high viscosity liquids, the speed of the pump must be reduced and the size of the lines increased to prevent cavitation.

Note: Pipe line friction increases at a rapid rate with an increase in viscosity. For a given pump and motor, larger pipe lines are necessary to maintain the same pump pressure when changing from a thin fluid to a thick one.

Most Tuthill LA and LE Series pumps are supplied with both ports on the same plane. Pumps with this type of porting arrangement should always be installed with both ports pointing upward to insure proper priming. If it is necessary to install the pump with the ports pointing to either side, it

is recommended that the top port be the suction port. This will prevent gravity induced drainage of fluid through the suction port. When pipe lines are installed, an inverted "U" bend should be incorporated into the suction line close to the pump for priming purposes.

The multiple port arrangement in the 5LE offers flexibility but is limited to some common sense restrictions. There is an inlet and an outlet side to the pump. There must always be at least one pipe on each side. Units ordered with the side port option (modification S) are shipped with port plugs in the top ports. To adapt to a 90° porting arrangement, the plugs must be relocated. Because of its size, the 5LE will not mount onto a NEMA 48 frame motor unless the motor is shimmed approximately ¼".

With the ports facing up, and viewing the pump from the shaft end, the inlet port is on the right for clockwise rotation and on the left for counter-clockwise rotation. Pumps with built in relief valves are directional. Therefore rotation must be specified at time of order. The adjusting screw of the internal relief valve must always be located on the suction side of the pump.

Pumps should be filled with oil at installation and should never be allowed to run dry.

Every pump installation should have a good foundation. Its structure should be sufficiently strong to hold the pump rigid and to absorb any strain or shock that may be encountered. The installation should be leveled, checked for proper piping alignment, and then fastened securely.

Method of Drive

Direct drive through a traditional flexible coupling is recommended. However, do not expect the flexible coupling to compensate for misalignment. Contact the coupling manufacturer to determine the maximum amount of misalignment to which the coupling can be subjected.

LA and LE Series pumps can be driven in either direction of rotation, unless outfitted with an internal relief valve. The seal chamber communicates with the neutral zone and therefore the seal is subjected to approximately one half of the discharge pressure.

All pump and motor units must be properly aligned during assembly and periodically checked since misalignment may occur later due to abuse or other conditions. Pipe strain can force the pump and motor shafts out of alignment. Therefore, all piping to the pump must be properly supported. Do not allow the pump to act as a pipe support.

Provide for proper expansion of pipes when handling hot liquids. Allow pump to reach operating temperature slowly. Rapid temperature change can result in damage to the cast iron components. Recheck the alignment.

Never align a pump and motor supplied with a pin type coupling without first removing the pins.

Never depend upon sight or feel. Use proper gauges when aligning the pump.

Never operate the pump without all guards in place.

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Relief Valve Protection

The LA and LE Series are positive displacement pumps. As the pump rotates, liquid is positively delivered to the discharge side of the pump. If the discharge line is closed off, pressure will increase until the drive stalls and/or fails, the pump breaks or ruptures, or the piping bursts. To prevent this from happening, the use of a pressure relief valve is required. A relief valve that directs the flow back to the supply tank is recommended.

The internal relief valve available on LE Series pumps is designed for overpressure protection only. It is not intended as a flow control device or for any similar use. Continuous operation of the relief valve will result in excessive heat buildup within the pump cavity, which could cause serious internal damage. Make certain the adjusting screw of the relief valve is located on the suction side of the pump.

Unless otherwise specified at the time of order, all LEV pumps are supplied with the standard spring, with a range of 55-120 psi (40-70 in the 5LE), set to provide full bypass relief at 55 psi. **Note that the ASL pump contains a special by-pass spring, which is factory set to provide full by-pass relief at 40 psi.**

To adjust the relief setting within the range of a given spring's capability:

- Remove the acorn nut. (Not supplied with model 5LEV).
- Insert a screwdriver into the slot of the adjusting screw and hold it steady.
- Loosen the locking nut with a wrench by turning counterclockwise.
- Throttle the outlet line until the differential pressure at the pump port is at the desired level:
- If the pressure fails to reach this level with the throttling valve closed, turn the adjusting screw inward (clockwise) until the desired pressure is reached. (Adjusting clockwise raises the pressure setting).
- If the pressure reaches the desired level before the throttling valve is completely closed, turn the adjusting screw outward (counterclockwise) until the desired pressure is reached. (Adjusting counterclockwise lowers the pressure setting).
- Retighten the nut to lock the setting in place and replace the acorn nut.
- Recheck the pressure gauge reading.

If an internal relief valve has not been supplied with the pump some other means of protection must be utilized. These include in-line safety relief valves, pressure shutdown switches or other similar devices.

Strainer Protection

Strainers are used to remove contaminated particles from the fluid system and extend pump life. Every pump should be protected from these particles by a strainer in the suction line.

Strainer size and mesh of screen are determined by the rate of flow and viscosity of the fluid. Consult the strainer manufacturer for recommendations.

Never use a strainer with a built-in automatic by-pass on the suction line set to open under 30" Hg. vacuum.

Install the strainer according to the designated direction of flow, locating it so that it is accessible for servicing. Use a duplex type strainer when shutdown during service is not possible.

Provide a vacuum gauge in the suction line for determining when the strainer requires cleaning.

Make certain strainer baskets are properly reinforced so as not to collapse under 30" Hg. vacuum.

WARNING

All Tuthill pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.

If the pump is to operate at elevated temperatures, it should be brought up to operating temperature gradually. Rapid or sudden introduction of liquid at an elevated temperature into the cold liquid chamber of the pump could cause damage to the seal or other internal parts.

Do not run the pump dry. This could cause severe damage to the seal, bushings and/or metal parts.

Startup

Prior to starting the pump double check the following:

- Pressure and vacuum gauges should be installed as close as possible to the pump.
- Rotate pump shaft to ensure it turns freely without binding.
- Recheck alignment and ensure all guards are in place.
- Make sure piping is independently supported and no strain is being transmitted to the pump.
- Make sure the safety relief valve is installed correctly.
- Check pump rotation.
- Open suction and discharge gate valves.
- Check for any leaks once gate valves are open.

After completing these checks the pump can be started.

CAUTION

The pump should not be run dry. If after approximately 60 seconds there is no discharge of liquid, stop the pump and investigate the possible cause. Failure to comply with this could cause severe damage to internal seals, bushings and/or metal parts.

Pump Performance Data

Size	**Capacity (gpm)**	
30L	.3	**Note: 30LEV-CC-A-9821 @ 1725rpm = .5 gpm**
00L	.8	**Note: 00LEV-040-CC-A @ 1725rpm = .666 gpm**
0L	1.6	**Note: 0LEV-040-CC-A @ 1725rpm = 1.333 gpm**
1L	2.7	
2L	4.9	Based on pumping a fluid of 200 SSU
5L	12.9	viscosity at 100 psi and 1750 rpm.

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WARNING

Failure to follow these instructions could result in serious bodily injury or death.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

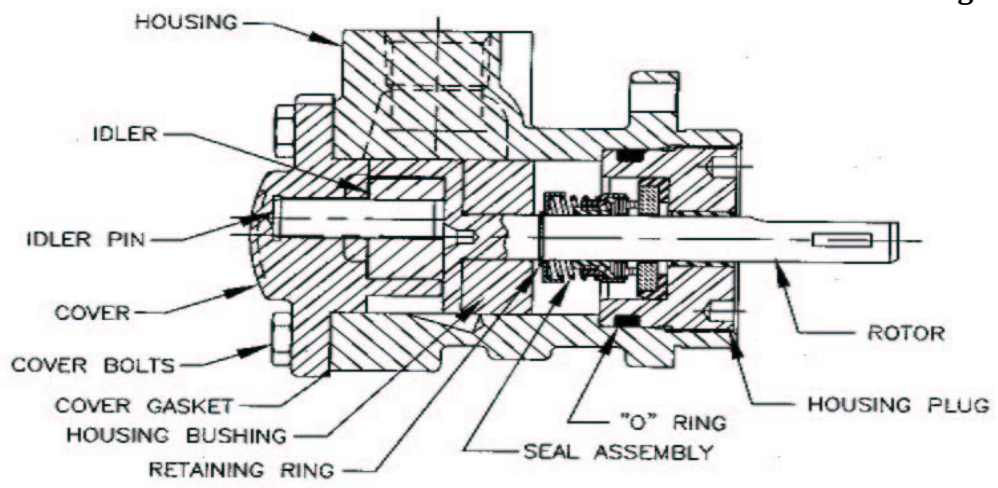
Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

All Tuthill pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.

IPB Starts on Pg. 57



Disassembly of Seal

The seal assembly in LA and LE Series pumps can be changed without disassembly of the rest of the pump.

- Place the pump in a vise with the shaft facing up so that one jaw grips across the two ports. Do not tighten excessively as the pump housing may be distorted.
- Inspect the shaft at the keyway, flat or tang. Any burrs will interfere with removal of the housing plug and bearing assembly.
- Remove the housing plug with a spanner wrench, available from Tuthill as p/n 0L 506.
- Remove the seal from the shaft. The rubber boot will be bonded to the shaft, so it is necessary to push down on the seal to break this bond. Grasp the metal outer shell with any suitable device and pull the seal assembly upward. Remove the spring and washer.

- Models 30LA through 1LA and models 30LE through 1LE have a snap ring on the shaft to back up the seal assembly. Do not remove this snap ring unless you are completely disassembling the pump. Models 2LA, 2LE and 5LE do not have a snap ring. A step on the shaft is used as the seal backup.

- Remove the stationary seal face from the housing plug by pressing out from the opposite side.

- If damaged, remove the O ring from the OD of the housing plug.

Disassembly of Pump

The seal assembly must be removed before the pump can be disassembled.

- Remove the snap ring from the shaft on all models except 2LA, 2LE and 5LE.

- Mark the cover and housing of the pump for proper re-assembly.

- Remove cover screws, cover, idler and rotor from the housing.

Inspection

Check the pump housing, rotor, idler gear. idler pin and cover for wear and chipped or broken teeth.

The housing bore and rotor OD may be checked for wear by positioning the rotor in the housing and checking for clearance in the bearing. The shaft must turn freely without any detectable side play.

Any side play will require replacement of the housing and/or rotor. If either of these two parts must be replaced, it is economically advisable to replace the entire pump.

Assembly of Pump

The following must be carefully followed when the pump is re-assembled:

- Clean all parts thoroughly using great care to eliminate all dirt.

- Install the rotor in the pump housing.

- Apply the gasket to the cover. Use a new gasket if the old one is damaged. (Models 30LA, 30LE and 5LE are also supplied with an O ring in the cover. Replace if damaged.)

- Place the idler gear on the pin in the cover assembly.

- Place the cover assembly with gear on the pump, aligning the matching marks for proper location.
- Install the cover screws. Tighten gradually, alternating from a screw on one side to a screw on the opposite side.

- Install the snap ring on the shaft (except models 2LA, 2LE and 5LE).

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Assembly of Seal

- Clean all parts thoroughly using great care to eliminate all dirt.
- Oil the shaft with a suitable lubricating oil. (If the pump has an EPR seal, apply a silicon based lubricant instead.)
- Apply the appropriate lubricant to the inside of the new seal assembly.

For standard full length shafts with flat and/or keyway:

- Place seal assembly on the pump shaft.
- Push seal down with your fingers to a position approximately half way down the shaft.

For modification “A” tang shafts: The ASL Pump is a Mod. “A” shaft

- Use tapered plastic sleeve, available from Tuthill as part number 1LPF 531 7010.
- Lubricate the sleeve.
- Place seal assembly on the sleeve. The tapered end of the sleeve fits into the spring end of the seal assembly.
- Place the slotted end of the sleeve on a bench. Press down on the carbon face of the seal with your fingers and slide the seal to about the midpoint on the sleeve.
- Place the slotted end of the sleeve over the tang on the pump shaft. Line up the outside diameters of the sleeve and shaft by eye.
- Push seal down with your fingers so that it passes from the sleeve to a position approximately halfway down the shaft.

- Press the stationary face into the housing plug. The lapped surface must be up. Protect this lapped surface by covering it with a piece of paper when pressing down on the face. Use your fingers for this operation.
- Place a new O ring on the OD of the housing plug, if required, and lubricate.
- Lubricate the carbon face liberally.
- Re-assemble the housing plug into position over the pump shaft. Do not nick the seal face by hitting the pump shaft. Tighten the housing plug with the spanner wrench. The seal will automatically be positioned by this operation.
- If the pump is equipped with a ball bearing (modification K), press the bearing onto the shaft. Do not hammer into position or press on the bearing outer race.
- Check pump for free rotation by turning the shaft with a suitable wench. There will be a definite resistance to turning because of the seal load. The pump must turn freely without binding.

Changing Rotation

LA and LE Series pumps are bi-directional and will work equally well in either direction with no modification. However, if outfitted with an internal relief valve (model LEV), these pumps become rotational. Rotation cannot be changed in the field unless the housing is replaced.
(**Do Not change rotation on an ASL Filtration System Pump**)

To change the location of the suction port on a pump outfitted with Tuthill's unique automatic reversing feature (models RLA and RLE):

- Remove the cover screws.
- Rotate the cover 180° so that the boss on the cover points to the new suction (inlet) port.
- Align the mounting holes and reinstall the cover screws.

Note: Location of the suction port cannot be changed in the field on RLEV pumps unless the housing is replaced.

Troubleshooting

No fluid is delivered.

- Power is not on.
- Net positive suction head available (NPSHA) is lower than required for the inlet conditions and the vapor pressure of the liquid pumped. Calculate NPSHA and redesign piping if necessary.
- Leaks in suction line or port passages. These can be detected by submerging the pressure line from the discharge side of the pump into a pail of liquid where the air will be seen in the form of bubbles.
- Direction of shaft rotation is incorrect.
- Pump shaft is not rotating. The coupling is defective or the tongue and groove are not engaged.
- The relief valve setting is too low. Liquid is discharging through the by-pass port. **On ASL Filtration Systems, the by-pass should be set so the pump enters "full bypass" at 40 psi maximum.**

Capacity is too low.

- There are air leaks in the suction line.
- Suction losses are too high. The suction lift is too great or the suction line too small or too long. This can be detected by installing a vacuum gauge directly at the pump suction. The maximum vacuum at the pump suction should never exceed 15" of mercury. Vaporization caused by higher vacuums will generally result in capacity drop off. Suction conditions must be redesigned.
- Pump speed is too slow.
- The strainer is too small or obstructed.
- The suction port or pipe is not immersed deeply enough in the liquid.
- Piping is improperly installed, permitting an air pocket to form in the pump.
- Increased clearances or wear in the pump will sometimes cause the pump to deliver an insufficient supply of fluid. This can generally be corrected by reducing the thickness of the cover gaskets. A folded gasket or a slight amount of dirt can exaggerate the problem and cause leakage.

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Pump works spasmodically.

- Leaky suction line.
- Varying suction conditions.
- Air or vapor in the fluid.

Excessive power draw.

- Pressure too high.
- Liquid is more viscous than originally expected.
- Suction or discharge lines obstructed.
- Insufficient horsepower.
- Drive shaft and pump misaligned.
- Pump binding due to insufficient end clearance.
- Pump shaft is bent.
- Misalignment within the pump due to bad piping or poor installation, causing strain or distortion.

Pump is noisy.

- Pump is cavitating due to inadequate suction conditions.
- Misalignment of coupling.
- Coupling is set too close to pump.
- Vibration of pump due to worn or bent shaft.
- Air leaks on suction side of pump or air entrainment in the fluid.

Pump leaks.

- Cover bolts need tightening or cover gasket is defective.
- Worn or defective seal.

Material Returns

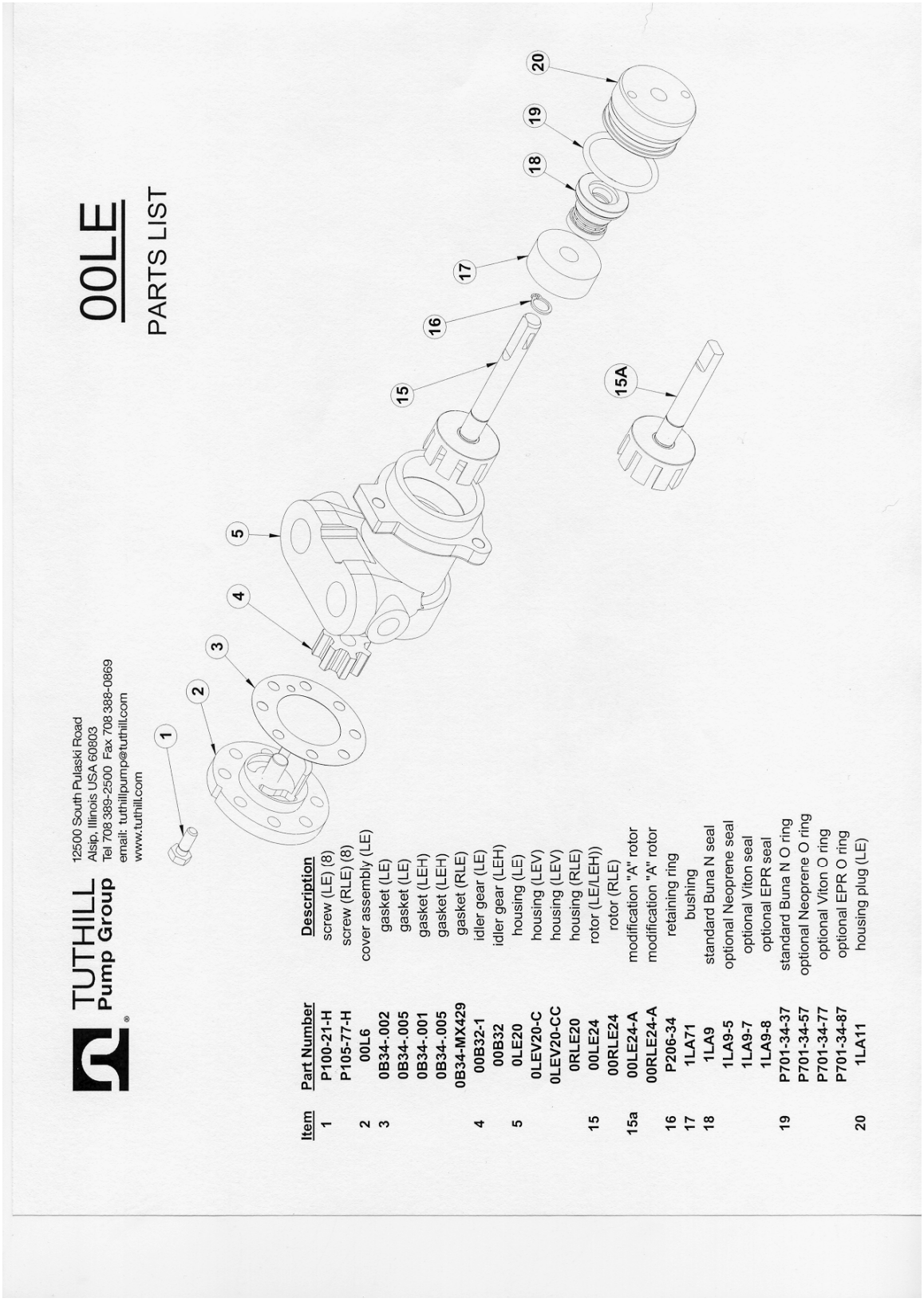
If it becomes necessary to return a pump to the factory, a Return Goods Authorization (RGA) must be obtained from either your local Authorized Distributor or our Chicago plant. No RGA can be issued until a completed Material Safety Data Sheet (MSDS) has been forwarded to our Chicago plant and return of the pump approved.

- Tuthill pumps are precision built and must be handled with care.
- Pumps must be drained of all fluid and the ports plugged to prevent foreign material from getting into the pump.
- Pumps must be packaged securely to prevent damage while in transit.

Contact ASL Technologies for return of Defective pumps installed in ASL Filtration Systems

ASL Technologies, LLC
10525 W US Hwy 30, Bldg 3D Wanatah, In. 46390
Phone 219.733.2777 or Toll Free 888-333.2990
Facsimile 219.733.2779 or e-mail custsvc@aslfilter.com **www.aslfilter.com**

S-40 PUMP = 00-LEV-040-CC-A



TUTHILL Pump Group

12500 South Pulaski Road
Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
email: tuthillpump@tuthill.com
www.tuthill.com

00LE

PARTS LIST

Item	Part Number	Description
1	P100-21-H	screw (LE) (8)
	P105-77-H	screw (RLE) (8)
2	00L6	cover assembly (LE)
3	0B34-.002	gasket (LE)
	0B34-.005	gasket (LE)
	0B34-.001	gasket (LEH)
	0B34-.005	gasket (LEH)
	0B34-MX429	gasket (RLE)
4	00B32-1	idler gear (LE)
	00B32	idler gear (LEH)
5	0LE20	housing (LE)
	0LEV20-C	housing (LEV)
	0LEV20-CC	housing (LEV)
	0RLE20	housing (RLE)
15	00LE24	rotor (LE/LEH))
	00RLE24	rotor (RLE)
15a	00LE24-A	modification "A" rotor
	00RLE24-A	modification "A" rotor
16	P206-34	retaining ring
17	1LA71	bushing
18	1LA9	standard Buna N seal
	1LA9-5	optional Neoprene seal
	1LA9-7	optional Viton seal
	1LA9-8	optional EPR seal
19	P701-34-37	standard Buna N O ring
	P701-34-57	optional Neoprene O ring
	P701-34-77	optional Viton O ring
	P701-34-87	optional EPR O ring
20	1LA11	housing plug (LE)

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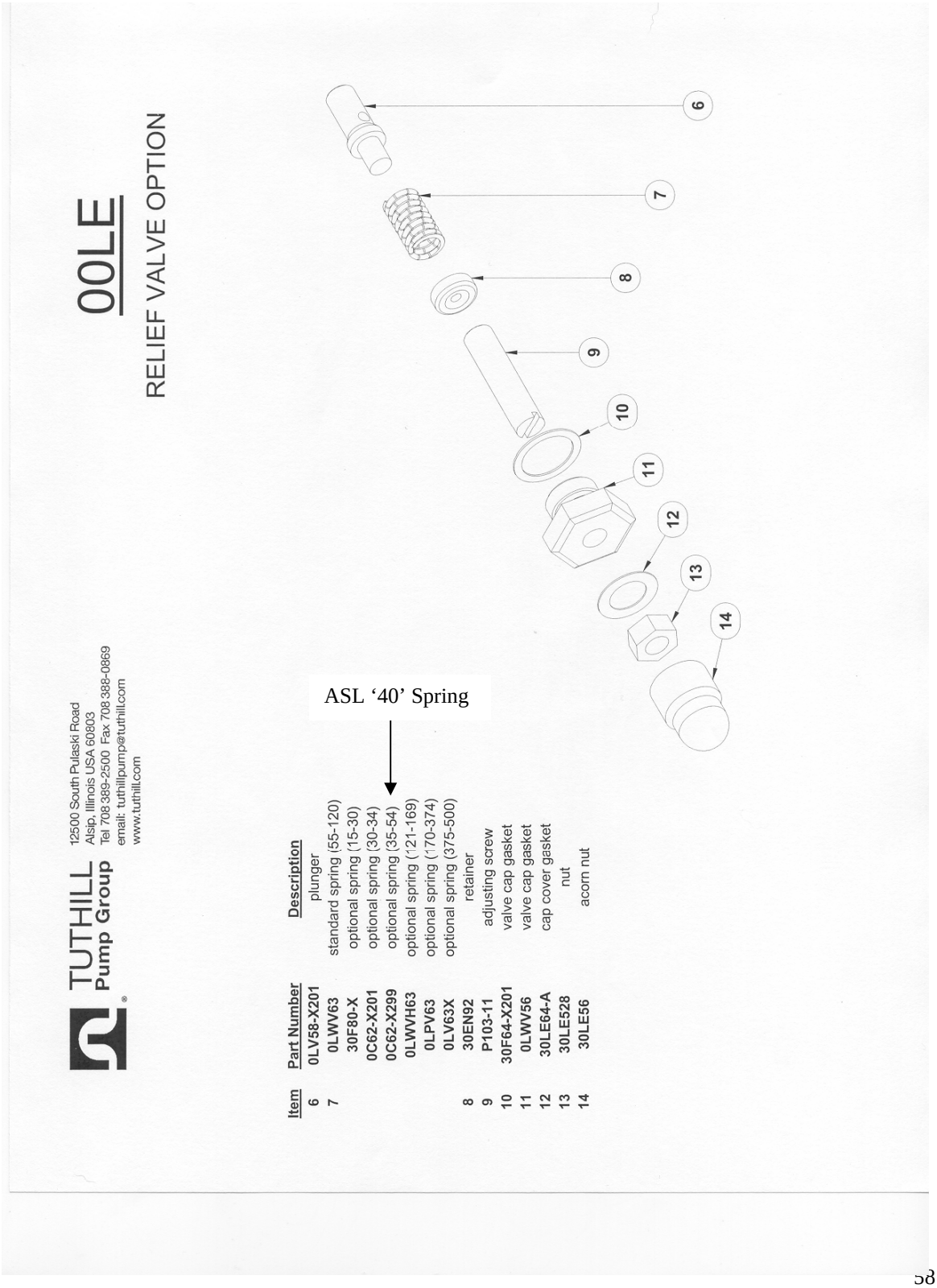

Item	Part Number	Description
6	0LV58-X201	plunger
7	0LWV63	standard spring (55-120)
	30F80-X	optional spring (15-30)
	0C62-X201	optional spring (30-34)
	0C62-X299	optional spring (35-54)
	0LWVH63	optional spring (`121-169)
	0LPV63	optional spring (`170-374)
	0LV63X	optional spring (375-500)
8	30EN92	retainer
9	P103-11	adjusting screw
10	30F64-X201	valve cap gasket
11	0LWV56	valve cap gasket
12	30LE64-A	cap cover gasket
13	30LE528	nut
14	30LE56	acorn nut

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S-30 Pump = 30-LEV-CC-A-9821

TUTHILL Pump Group
12500 South Pulaski Road
Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
email: tuthillpump@tuthill.com
www.tuthill.com

30LE

PARTS LIST

Item	Part Number	Description
1	P100-1-H	screw (5)
2	30L6	cover assembly
	30L31	pin
3	P701-197-37	standard Buna N O ring
	P701-197-57	optional Neoprene O ring
	P701-197-77	optional Viton O ring
	P701-197-87	optional EPR O ring
4	30L32-PPS	idler gear (LE)
	30L32	idler gear (LEH)
5	30LE20	housing (LE)
	30LEV20-C	housing (LEV
	30LEV20-CC	housing (LEV)
15	30LE24	rotor
15a	30LE24-A	modification "A" rotor
16	P206-34	retaining ring
17	30LA71	bushing
18	1LA9	standard Buna N seal
	1LA9-5	optional Neoprene seal
	1LA9-7	optional Viton seal
	1LA9-8	optional EPR seal
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	P701-34-87	optional EPR O ring
20	1LA11	housing plug (LE)

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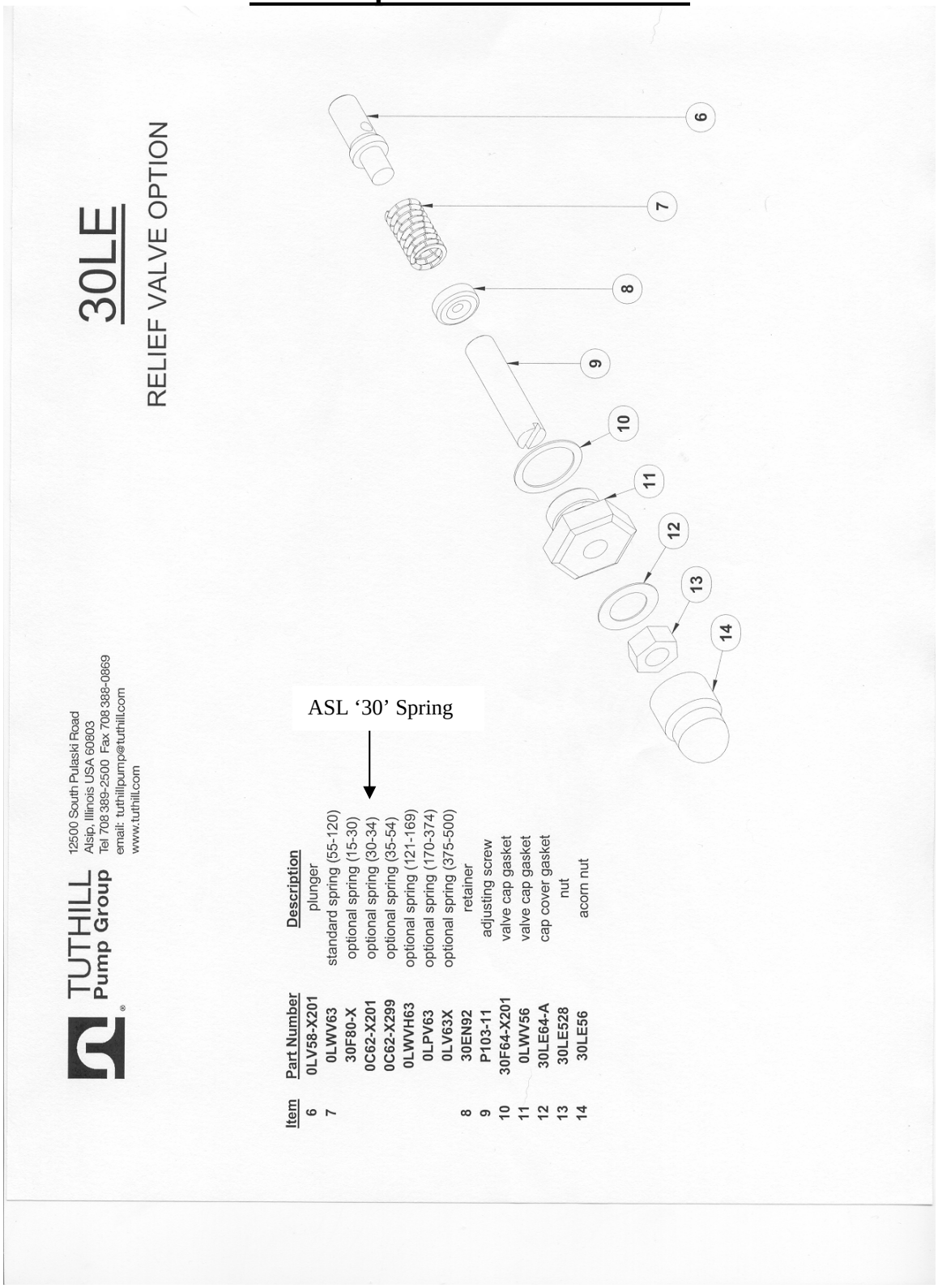
S-30 Pump = 30-LEV-CC-A-9821



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END OF SERVICE MANUAL